WOOD-FINISHING

JEFFREY

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WOOD-FINISHING

By

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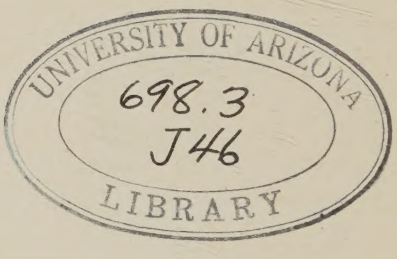

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PREFACE

THE aim in writing this book has been to put before teachers, students, and amateur workers reliable information regarding the most common processes of wood-finishing, and to present this information in a practical, non-technical manner, suitable for the average school shop. An attempt has been made to put the maximum amount of information regarding the subject of wood-finishing into as few pages as possible without sacrificing clearness. The plan has been to take this information out of the catalog and reference book class, and to make of it a volume which every one can read understandingly. While the book has been written primarily for schools and colleges, it should find a most serviceable place in the home and shop. Furthermore, the purpose has been to widen the scope of the student's knowledge of what is beautiful as well as useful, and to take him gradually beyond the "mud and varnish" stage of craftsmanship by placing before him suggestions for something better, thus creating a new standard for the judgment of his own product as well as that of others.

The chief difficulty in writing a text of this kind lies not so much in what to include as in what to exclude. No book, except an encyclopedia on the subject, could be complete, and such a work would be of little use to the student. From the enormous fund of information available, selection has been made only of those formulas and suggestions which were thought to be most serviceable and valuable to the reader.

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Wood-finishing is properly a fine art. It belongs to that better conception of manual arts which has as its aim the creation of something *beautiful* as well as something *practical*. Too often, I believe, this former ideal has been neglected in the shops of our schools, and yet it remains the chief satisfaction of people in school and out of it.

In offering this book to students and teachers, I wish to express my indebtedness and gratitude to Professor Clark L. Jackson, of The Kansas State Teachers' College of Emporia, for his kind assistance in the various processes of preparing the manuscript for publication; and to Professor E. A. Johnson of Bradley Polytechnic Institute, for reading the manuscript. The author wishes to acknowledge, also, the co-operation of The Mahogany Association, and The American Walnut Manufacturers' Association, in permitting the use of some of the photographs contained in the book.

HARRY R. JEFFREY.

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CHAPTER I

Preparing the Wood for Finishing

1. The Value of Good Finishing.—Too often we find a well-constructed piece of work poorly finished. Indeed this is the most common evidence of amateur work. Students, as a rule, seem to think that the prime necessity for a good product is costly lumber, and that the piece is finished when they have completed the construction of it. With this idea in mind they often spend a great deal of time making their project and hurry over the finishing of it in a careless manner. Students should learn that it is not so much the kind of wood used in a piece of work that determines its value, as it is the honest construction and careful finishing of it. An extremely expensive article may be made of very common material, while in some articles mahogany, walnut, or even more valuable woods, may be almost worthless. Do not consider your work completed until you have achieved an appropriate and artistic finish. Beautiful wood is, of course, desirable, but it is never the chief source of value of a piece of furniture.

2. Preparing the Surface for Finishing.—The first step in finishing wood is to make a smooth surface. The work must be gone over and all spots and grease marks removed. Grease spots or discoloration may be taken out usually by rubbing the surface with a cloth or sponge dipped in benzine. Excess glue may be removed with sandpaper or a scraper, care being

taken not to injure the surface of the wood. If glue has been spilled on the work it must be removed not only from the surface *but also from the pores of the wood.* Glue acts as a filler and prevents the stain and the subsequent filler from entering the wood. It may be taken out of the wood by applications of a cloth which has been wrung out of boiling water.

3. Restoring Dented Surface in Wood.—Ordinary dents in wood may be removed in the following manner: Wring a piece of muslin, or some such cloth, out of water, lay a couple of thicknesses of it over the dent to be removed, and apply to it a hot pressing iron or piece of heated metal, so that the steam will enter the wood. Repeat this process until the dent is removed; sandpaper the part that has been moistened. The surface will be restored.

4. Filling Holes.—If a piece of wood has been broken from the surface the hole may be filled in one of the following ways:

1) In case the hole is large, the only practicable way to fill it is to insert a piece of wood to match that of the rest of the work. If, however, there is only a small crack or hole to be filled, no difficulty will be had in using any of the following methods:

2) Mix some fine sawdust from the wood you are using into a thick paste with ordinary glue and fill the hole or crack, being careful not to allow the glue to spread over the wood which surrounds the hole.

3) For filling cracks in hardwood, mix together one part of cornstarch and one part of wheat flour. Add to this one part of linseed oil with one part of japan drier. This will take any stain which you may apply

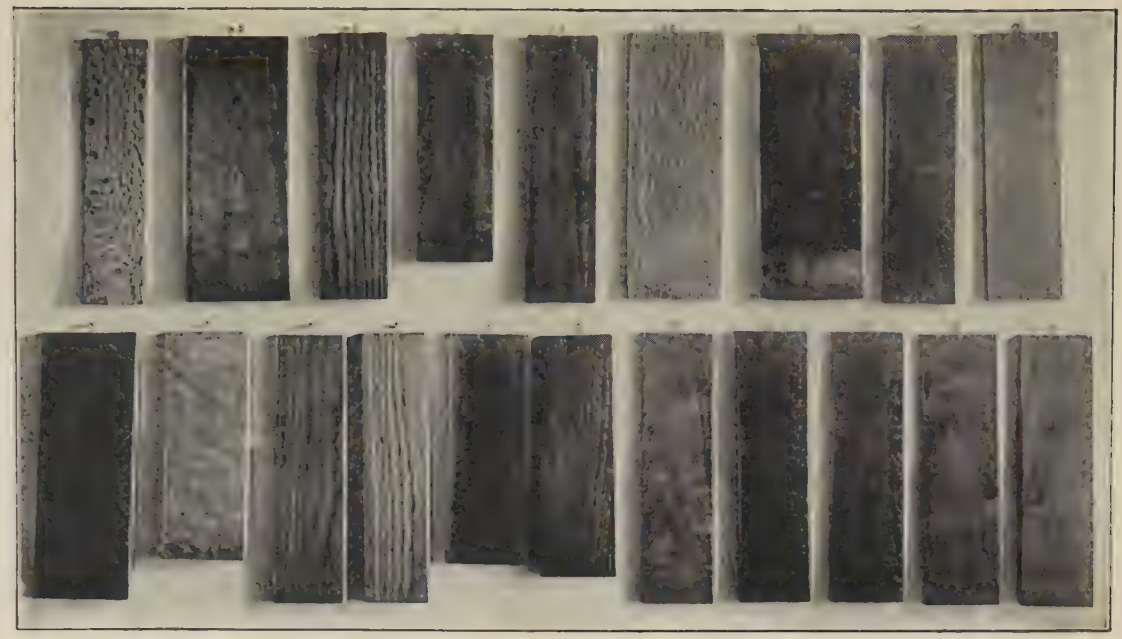

FIG. 1. A collection of wood panels finished by students.

to the wood. If the work to be filled has already been stained, match the color by adding a correct amount of *oil stain.*

4) Melt together in a pot one part of beeswax, one part of powdered resin, and twelve parts of orange or white shellac. Be sure not to allow this mixture to be heated to the boiling point or it will be rendered too brittle for use. This may now be used as a base with which to form any color you may wish. As it will not take a stain that is applied to the wood, the best method to obtain a good result is to stain the wood the color you wish it; apply a coat of shellac to bring out the color; then mix with the wax (by melting it again) sufficient color to match that of the wood, and fill the holes, pressing the wax into them with a putty knife and smoothing off the surface. It is well to color only enough of this beeswax, resin, and shellac base each time to fill the work in hand. The following pigments may be used to obtain the ordinary colors:

Color Desired	Pigments Used
Light brown	Burnt umber and yellow ochre, equal parts.
Medium brown	Burnt umber.
Dark brown	Burnt umber and lamp-black.
Light red	Venetian red and yellow ochre.
Medium red	Venetian red.
Dark red	Venetian red and lamp-black.
Black	Lamp-black.

Analine dyes which are soluble in alcohol (there are other kinds of these dyes which are soluble in water and oil) may be used if other colors are desired.

The best way to apply this wax is to roll it into a convenient stock form and use like sealing-wax. It is the

best crack and hole filler for cabinet work, and the student will experience little trouble in using it if a quantity of the base (without coloring) is made up ready for use.

5. Sandpapering.—When the surface has been leveled off and all holes have been filled, the work is ready for a final smoothing. This is usually the part of the process of finishing where amateur work is apparent. A student is ordinarily too anxious to complete his work, and hurries over the smoothing of it thinking that this will have but little effect upon the final result. Nothing could be further from the truth. The whole final appearance of the piece is dependent upon this part of the process. If the sandpapering is half done—as it usually is,—no amount of care in the application of the stain or varnish or polish will make a satisfactory finish. The reason for this is that unless the surface is as smooth as it can be made the rougher parts of it will absorb more stain and filler than the smoother and consequently will show darker. No amount of matching will make the work so satisfactory as it would have been had it been properly smoothed in time. Remember that it is not worth while to begin a piece of work if you do not intend to spend a proper amount of time in finishing it. Of the many processes involved in converting lumber to furniture the longest and most important is the finishing.

If the surface is plane, you may remove any slight unevenness with a very sharp scraper. It should then be rubbed down with No. 1 sandpaper, and finally with No. 0 paper. This must always be done in the direction of the grain, except when working on the ends of

wood. Should you rub across the fibers, the sandpaper will invariably cut small lines in the wood. These may not show until the stain or filler is applied, but they will become apparent in some part of the finishing process. Be careful, too, not to round off unduly the corners or arrises as is usually done in amateur work. The best manner in which to use sandpaper is to prepare a small block (3″x5″ is a convenient size), and tack a couple of layers of heavy cloth to the sides so that the face of the block is covered to form a pad between the sandpaper and the block. This will distribute the abrading force of the paper evenly over the wood. Brush the work off well and look carefully to see that there are no rough parts before beginning the staining.

6. If a Water Stain Is to Be Applied.—The wood needs special treatment if a water stain is to be applied. First, sponge the surface liberally with lukewarm water and allow it to dry. It will then be seen that a considerable amount of "fuzziness" has risen. This must be sanded down with No. 0 or No. 1 sandpaper, in the manner described previously. Now apply the stain hot with a brush and allow it to dry. If the color is not sufficiently dark apply another coat of stain. Allow this to dry. Again a slight fuzziness will be noticed, not so much, of course, as before. Now apply a coat of *very thin* shellac (6 oz. gum shellac to a quart of alcohol). This shellac, when it dries, stiffens the fine fibres of the wood which have risen to cause this fuzziness, and the work may now be rubbed down to a beautiful surface with No. 0 sandpaper. This may seem to the student a long way to obtain results,

because he has thought of finishing as the short and quick part of the process. The next time you admire the beauty of the finish on an expensive piano, remember that this instrument has been in the finishing room of the factory for at least three months.

CHAPTER II

Staining

7. The Purpose of Staining.—After all the surfaces have thus been prepared, the work is ready for staining. The student should know the purposes of staining, what kinds of stain he may use, the appropriateness of the color to the wood, and the results he may expect.

The purposes of staining are to produce a soft and agreeable color; to match the various shades of the wood; to harmonize the work, in the way of color, with other furniture; and to bring out in varying degrees of depth the natural beauty of the wood which may in its unfinished state be raw and unpleasing to the eye. We may easily be convinced of the value of artificial coloring in beautifying wood by comparing the softness of some of the rich browns and reds with the obtrusiveness of the so-called natural wood finishes. Staining does not make a piece of wood artificial. It merely brings out the hidden beauty of the wood, and in many instances adds to the natural color which we have thought typical of it. Oak seems to us most appropriately colored in different shades of brown, mahogany in various hues of dark red and dark brown. Whenever possible it is well thus to adapt our color to the typical shade of the wood. We shall then avoid such a monstrosity as mahogany-colored oak, which I once saw, or dark-red walnut. Where the prevailing tone of the wood is white, as in maple, poplar, and

FIG. 2. Matched panel of 4 pieces of stumpwood. The beauty of this grain is enhanced by staining.

willow, we must adapt our color to the needs of the piece.

8. **Matching the Color of Woods.**—Very often there is a great variation in the colors of different parts of the wood in hand. A piece of white oak may have been placed beside a piece of red oak, or a piece of African mahogany against one of Spanish mahogany. Again there is usually some sap wood of a lighter color and a more porous texture in a piece of work. Artistic treatment is required to make even the color. The easiest methods to follow in matching these colors are as follows:

To match light and dark colored oak, apply one coat of the stain you are using to the light part with a small brush, being careful not to stain over the edges of the light portion and into the dark. Allow this to dry and then cover the whole piece with a coat of the stain. Remember that the more porous the piece of wood the darker will it become under the stain in consequence of its greater absorbing power.

The sapwood in walnut is much more porous than that of the heartwood. A coat of strong coffee or water stain to which is added about a fifth of hot vinegar will often darken the light part sufficiently. The vinegar is necessary to help the stain to "bite" into the wood, and to keep it from fading.

Frequently we find pieces of beautifully striped mahogany used with plain wood, especially in large surfaces like table tops. This is not difficult to remedy. Apply a coat of stain to the whole piece. Before this is dry (wait only a few minutes) take a slightly darker stain or one that is somewhat stronger, and with a

small, soft brush imitate the stripes of the wood to be matched in the plain wood. If this is done carefully only an expert will be able to distinguish the two. The second application will feather itself into the moist first coat and no line of demarcation will be seen.

Birch, poplar, and white maple may be matched with

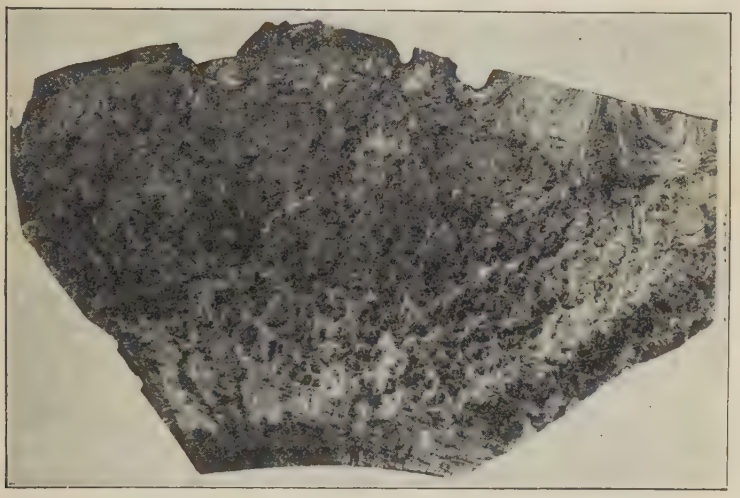

FIG. 3. Exceptionally fine specimen of bird'seye walnut from a burl.

mahogany in the same manner. Give the light wood one or two coats of your stain, allow this to dry, and then coat the whole piece.

Sometimes you will be unable to match woods in this way. The curls in maple, mahogany, or redwood may not be imitated with stain alone. But the process really belongs to polishing and will be treated under that heading.

9. **Bleaching.**—There are often dark spots in wood that is to be finished light. These may generally be

removed by applying a solution of oxalic acid (2 oz. to a pint of water) hot to the dark portion. Repeat this process until the wood has assumed the right color, and then wash the parts with hot water to stop the action of the acid. *Oxalic acid is very poisonous. Be careful in using it,* and above all make the solution in a porcelain dish.

10. **Darkening.**—Darkening wood may be accomplished in many ways, the principal of these being the application of stain. Linseed oil (preferably raw oil in this case) has a beautiful darkening effect if it is applied directly to the wood. This is usually used, however, upon dark woods such as walnut and mahogany. Oil seems to bring out the beauty of the wood and darken it in a manner that nothing else will do. Its application is very simple. Merely rub the surface of the wood with a cloth dipped in warm linseed oil. Allow this several hours in which to soak into the wood, and then remove any excess grease or sediment with a cloth moistened in alcohol. The use of alcohol on the cloth is especially necessary if a varnish finish is to be applied. No other stain is usually added if oil is used, but the oil may be colored to suit the taste with a little oil stain. Wax finishing is particularly well adapted to this kind of work. Do not use a great quantity of oil on the cloth. Do not attempt to use a water stain after oil is applied.

11. **Staining End Grain of Wood.**—It is in this particular that slipshod work may be noticed easily. The ends of wood should be smoothed as carefully as the face surfaces. Remember that this part of the wood will absorb color and filling much more readily

FIG. 4. Walnut burl over Washington's Tomb. Tree died in 1916 and was cut down.

than the side grain. It is therefore necessary to use a stain of only half the strength that is used on the face side and edges in coloring the ends of the wood. It is much better to use several lighter colored coats than to make a single dark application do. The color will be much more evenly distributed, and a more accurate color will be obtained.

12. Stains.—While it is true that the most satisfactory stains may be bought in quantity from any paint shop, it will doubtless be well to explain the natures of the different kinds of them, and even to suggest recipes for making some of them if it is necessary.

Stains may be classified, in general, under six heads: (1) water, (2) spirit, (3) chemical, (4) oil, (5) wax, and (6) varnish. These names denote the mediums with which the colors are severally compounded. Some experts prefer one kind, and some another. It is safe to say that water and oil stains are most commonly used. Do not infer from this statement that these classes of stains are necessarily the most satisfactory for every kind of work. Each seems to have its particular purposes for which it is best adapted.

13. Water Stains.—These stains may be purchased in powder form, and indeed the amateur is advised to buy his stains. They will probably be much more satisfactory than those which he would make. To this class of stains belong one kind of analine dyes (the kind that is soluble in water), vegetable coloring of all kinds, indigo, logwood, barks of trees, and berries. Of these the analine dyes are best, because they do not have such a tendency to fade as do the vegetable colors. They also penetrate the wood very deeply—which

is a desirable quality—and seem by the nature of their medium (water) better adapted to most classes of work than any other stain. Water stains should be applied hot to the wood with a brush. Speed in application is also necessary if an even color is to be had. It is well to cover the hands with vaseline if much staining or cleaning is to be done. This will keep the stain from discoloring them.

On the other hand there is one objection to a water stain. It always raises the grain of the wood to some extent. This may be remedied in the manner that has already been explained. If a water stain is to be applied, always sponge and rub down the piece of work before using the stain. This will minimize the effects of the rising grain, and will present a porous surface for the stain to soak into.

Never apply a large quantity of any stain at one time. You may discover whether or not you are using too much by allowing a few days for the stain to soak into the wood. If upon examination you find tiny rings of coloring around the coarser pores it means that your work is sweating because of the gases which have formed in the pores, and which have forced the stain out upon the surface. Exudation of this kind must be cleaned off with a rag or brush dipped in alcohol. The work should then be allowed to dry for a week, and then inspected for a similar fault. If no further action has taken place, the piece may be matched using as little stain as necessary. If, however, a further sweating has begun you will do well to clean the piece entirely and restain it.

14. Formulas for Water Stains.—The following

water stains may be made easily and will give good results:

Mahogany. One ounce of Bismarck brown dissolved in three quarts of boiling water.

Or, for the reddish brown color, mix together *mahogany red* and *mahogany brown*—commercial water stain powders—in the proportions of six of the red to four of the brown. Dissolve two ounces of this mixture in one quart of boiling water. (The wood should first be sponged off with a solution of a teaspoonful of Lewis' lye dissolved in a quart of boiling water, and allowed to dry, then sanded lightly to smooth the surface. The stain may then be applied, and, after it has dried, treated in the manner that has been suggested.)

Walnut. Mix together equal parts of burnt umber and Vandyke brown and make a thin paste by adding liquid ammonia. This mixture will not last well on account of the extreme volatility of the ammonia. When it is used thin this paste to a watery consistency with water. Be careful not to bring the ammonia into contact with heat. Apply with a brush and treat as has been suggested.

Ebony. The best ebony stain may be prepared as follows: Place in a metal dish one-half pound of logwood and three quarts of water. Allow this to boil until the compound has evaporated to about half its original amounts. Now add about a cupful of walnut peeling. Let this mixture boil for several hours and then add a pint of boiling-hot vinegar. If the work is in small pieces the best result may be had by dipping it in the stain. If not, *apply several good* flowing coats, one after the other and before each preceding coat is

dry. The stain will penetrate much more deeply if it is applied in this manner. Allow the work to dry a little (not completely), and apply two coats of a solution made by dissolving one-half ounce of green copperas (green vitriol) in a pint of boiling water. This will give a rich black color to poplar, apple, cherry, or pear wood. If a small piece of wood is to be ebonized dip it into the solutions. Do not attempt to ebonize woods of a resinous nature such as pine and fir. A fine-grained, non-resinous, hard wood is most satisfactory. White maple may be used if apple, cherry, or pear are not to be had.

In place of the above recipe, black India ink may be used, but it will not give so satisfactory results as the stain described.

15. **General Directions for Water Staining.**—Water stains should, whenever possible, be applied hot with a brush. The brush must not be dripping wet, but merely contain enough stain to flow over the work easily. Work rapidly if you expect to get an even color. Be careful not to allow the stain to run over the ends of your work. The stain which is applied to end grain must not be more than half the strength of that which is applied to the face and edges. In water staining it is always a good thing to add about one part of boiling vinegar to seven or eight parts of the stain. Match up the colors of your wood carefully. If you are in doubt as to the final color of your stain, test it on a well-prepared block of wood similar to that which you are using. Treat this piece in exactly the same manner as you intend to treat your work, finishing it with equal care, otherwise your time spent in

testing is wasted. Do not be discouraged at the dirty appearance that most woods have just after the stain is dry. It will lighten up wonderfully under the polish.

16. Spirit Stains.—These stains penetrate well and give quite a brilliant color. They also dry more quickly than water stains, and much more quickly than oil stains. Excellent results may be had with them, but they have several disadvantages. In the first place, it is more difficult to obtain an even color with them than with water stains, because they dry so quickly. The colors are often a little too metallic to be suitable for wood, and they frequently fade out under light. However in cases where water stains cannot be used, such as over any surface that has been oiled to darken it, or over a surface that has at one time been filled or polished, these stains are quite serviceable. In general, spirit stains are used for quick work, for rapid matching, and for renewing broken or abraded surfaces. Their use is not recommended for beginners.

17. Composition of Spirit Stains.—Any color that is soluble in alcohol will make a spirit stain. One kind of analine dyes—the kind that is soluble in alcohol as distinguished from those which are soluble in oil and water—may be used with good results. For particular work, if you wish to use these stains, you will do well to buy them ready for use.

18. Applying Spirit Stains.—Spirit stains may be applied with a cloth or with a brush, preferably the latter. The deeper effect will be had if the stain is applied with a brush and allowed to penetrate as deeply as it will. Very often, in order to bring out the "figure" of the wood more prominently, the stain,

after being allowed to remain on the surface for a short time, is wiped off with an absorbent cloth. This tends to brighten the "highlights" on figured wood. Many different kinds of mottling and streaking may be made at this time. Light and dark bars as are seen in mahogany may be imitated at this time in the manner described under matching the color of woods (see Sec. 8), or may be accomplished as directed in the following paragraph.

19. Matching Birch and Mahogany.—Suppose that a piece of birch is to be finished to imitate mahogany. First, give the whole piece a coat of stain of the shade which the lightest portions of the work will be when it is finished. Then cover the streaks which are to remain light (taking a piece of mahogany as our sample) with a coat or two of thin shellac. After the shellac has dried apply another coat or two of the same stain. This will darken the parts which are not covered with shellac. Successive blocking out of portions of the wood with shellac, and treating the exposed parts with different strengths of stain will give almost any desired effect. When the staining is completed, wipe off the shellac with alcohol and give the whole piece one or two thin coats of shellac with a brush. Allow this an hour or two to harden, and then rub down lightly with sandpaper (No. 0 or 00). The work may then be filled and polished. The only difficulty that the student may have in doing this work is that he may use too heavy a coating of shellac, and as a result the filler will not enter the grain or adhere to the wood. Six ounces of gum shellac to a quart of alcohol is a sufficient compound to use. Even with this amount of

shellac used the student will do well to fill the wood with a mixture of French polish and colored silica, a process that is described under Sec. 81. An oil or water stain may be used instead of the spirit stain if the student finds that the alcohol of the spirit stain softens the shellac coating which he has applied to protect the lighter parts of the work. If difficulty is encountered, it is probable that the stain has been brushed over the shellac too much, or that the shellac has not been allowed to dry well after the spirit stain has been applied.

20. Oil Stains.—These stains may be prepared by mixing colors that will dissolve in linseed oil or turpentine with these as bases. Umbers, sienna, analine dyes (the kind that is soluble in oil), alkaline dyes, and all other pigments *that are ground in oil.* The oil stains are quite easily prepared, and in many respects are excellent for student use, altho they do not have the popularity of the water stains on account of their slow-drying qualities, and on account of the fact that they often leave a muddied appearance on the wood, and seldom, if ever, give that desirable clearness of the water stains. Oil stains, too, do not penetrate the wood as spirit or water stains do, and they seem to fade quite easily. Oil stains do not, of course, raise the grain of wood, and so they, like spirit stains, need not be preceded by sponging and sandpapering.

The oil itself in these stains always darkens wood appreciably. A very simple manner of bringing out the figure of expensive woods is to apply a coat of oil stain, allow it to penetrate the wood for a short time and then wipe off, with the corner of a piece of

cloth, the parts that you wish to remain a lighter color. This will intensify the streaks of mahogany or the wavy bars of curley maple or redwood. The only thing to be guarded against in this process is the line of demarcation that may result between the light and dark parts. The dark should be shaded into the light by careful work with the cloth.

21. **Applying Oil Stains.**—Oil stains like others are applied directly to the wood with a brush. Do not attempt to use an oil stain over a surface that has been at any time *filled.* It will not enter the pores of the wood, but will merely remain on the surface to be brushed up in patches with the varnish or polish. Oil stain on new wood should be allowed a considerable length of time to dry into the wood. Any excess may then be removed with a cloth. If the finish to be applied is varnish it is well to remove any greasiness that may remain on the surface with a cloth moistened with alcohol. This will allow the varnish to "take hold" of the wood better. The oil in this kind of stain has a particularly pleasing effect upon dark hardwoods such as oak, walnut, and mahogany. Be sure that the surface of your wood is entirely free from any roughness or the abraded parts will be muddy and will give a very displeasing result.

22. **Wax Stains.**—These stains are the simplest to make and to apply. All that is necessary for a satisfactory finish may be summed up in a few words. Melt together one part of beeswax, eight or ten parts of turpentine (this may be reduced to five or six parts if the wood is, like oak, very open-grained), and sufficient oil-coloring or oil stain to make the desired color. Use

a strong mixture of the coloring or it will not show upon the wood. This melted compound is applied hot to the wood with a stiff brush, and allowed to harden. It is then brushed first across the grain and then with the grain with another brush (an old clothes-brush will do), until a polish appears. Successive coats may be applied in this manner, each brushed into the wood, until a desired depth of color is obtained. Strictly speaking this is not a stain, as it does not enter into the wood. This form of combined stain and polish is used most frequently upon oak, mahogany, and walnut, altho its use is not restricted to these woods. Many of the close-grained dark woods take on beautiful effects under it.

23. Chemical Stains.—These stains are composed of chemicals and rely, for their effect, upon certain chemicals in the wood which are changed. This change differs with different woods. Because a certain chemical stain gives a brown color upon a piece of oak, that does not mean that it will have the same effect upon a piece of ash, or indeed, upon another piece of oak. Color, in general in applying these stains, depends upon the amount of tannic acid in the wood. This differs in woods and in parts of wood. The stains are used in two ways: they are either applied directly to the wood like other stains, or allowed to fume the wood. Ammonia, nitric acid, potassium bichromate, acetate of iron, acetic acid, sulphate of iron, Roman vitriol, and many other chemicals are used in this process. Chemical staining has certain advantages over all other staining. It is inexpensive, it is penetrating and darkening, and it adds that most desirable appearance,

"age," to certain woods. It has also certain disadvantages. It raises the grain of wood much like a water staining, and one can never be absolutely sure of the result he will achieve until he has tried it on his wood. Chemical staining has become very popular, and it justly deserves to be so. Every student should finish some pieces in this way in order that he may become thoroly familiar with a few processes of it. A few common chemical stains are given here, while others will be given in Chapter XI.

24. Formulas for Chemical Stains.—*Mahogany.* A good darkening stain for mahogany may be prepared by dissolving one ounce of bichromate of potash in two quarts of water. This will give a dark brown color. If you wish to preserve the reddish cast of the wood, use one ounce of good mahogany water stain powder with the ounce of potassium bichromate. Apply the stain hot with a brush. Potassium bichromate stain should be allowed to dry in a well-lighted room just out of the direct rays of the sun.

Oak. The above stain without the *mahogany water stain* will make a beautiful nut brown if it is applied to oak. If a lighter color is desired make a solution of two ounces of American potash and two ounces of pearl ash dissolved in a quart of water.

Walnut. The bichromate of potash stain has a pleasing effect upon walnut.

25. Fuming.—This process really comes under the head of chemical staining, and so will be considered here. Fuming applies, in general, to the treatment of oak to give varying effects of brown to the wood. It is sometimes used on other woods, but for the stu-

dent's use we need only treat it with regard to that wood.

Fuming wood means subjecting the wood to the fumes of ammonia. This method of treating cabinet work and wood work is quite old and of recent years has come more and more into demand. It has every advantage over any other treatment of oak without any disadvantage. It is penetrating, so much indeed that the surface of the wood may be rubbed quite a while with sandpaper before the unfumed surface is produced. It does not fade, and, even more, age only serves to darken and beautify the result. It is particularly well adapted to the treatment of oak, for it seems to bring out in varying shades of brown the rugged quality of this wood that has made its history. Who can help feeling a certain amount of revulsion when he sees a suite of golden oak furniture, with its sleek shining pasty surface? To all who realize the story of this wood such a finish is almost a desecration, the cheapest, the most inartistic, of all wood finishes. Besides this, who does not note the quiet beauty and unobtrusiveness of Jacobean and of fumed oak? Such furniture seems to fit into a room, to reflect the character of the home and of the people who make it. We do not yet correctly estimate the value of this wood in our country. It has been so common to most of us that we are apt to depreciate its worth. But every student should know that, all in all, there is no greater wood than oak, nor indeed any so great. Fads in the treatment of it, green oaks, lemon colored oaks, golden oaks, and even silver oaks (altho this last has often a pleasing appearance of age), may come and go, but

FIG. 5. A group of walnut panels showing a variety of grain.

the beauty of rugged simplicity in design and of warm nut-brown coloring and suitable polish in finishing must remain perennial.

How often have we not entered a supposedly "high-class" furniture store looking for something serviceable and at the same time beautiful. And how often have we not been obliged to come away almost despairing of finding what we wanted, and not "something just as good and cheaper." Oak tables with thinly veneered tops—which the salesman told us was necessary to match the grain of the wood; oak beds in which the most of the wood was ash and elm; fumed oak pieces that showed at their corners that the fuming had not been done at all, but that the wood had merely suffered from an ammonia wash with coloring added to deceive the uneducated buyer, all these things we have had foisted upon us, and it is a part of the training in manual arts to show the student how to recognize cheapness. Of course, veneering has a legitimate use in panelling and such work, and bright mirror-like surfaces are sometimes permissible, even beautiful, over highly figured woods and in small decorative pieces, but the supreme thing in furniture now remains as simple, beautiful, constructive lines, and subdued and harmonious color and polish. In the treatment of oak, fuming and waxing is the most artistic of all finishes.

Fuming, besides being the most artistic finish for oak, is one of the simplest for the student. Like oil polishing it requires time, and for this reason the real result is imitated by many cheap processes. But the student has not much need for hurry, and he can, if guided and motivated by the influence of the instructor, set

his own standard of wood finishing. I have been surprised as I have visited various manual training shops over the country at the infrequency with which this treatment was used. Students seem to think that it is a long, arduous task, which is difficult to do and uncertain in its result. This idea is far from true. Any student may get excellent results from a little care and patience in following the directions prescribed below.

26. The Fuming-Box.—The first necessity for this process of coloring is a suitable box in which to place the pieces which you intend to fume. This box should be just a little larger than the largest piece that you intend to make. Perhaps it will be well to have the students make a good tight box which will serve as a container whenever any of the class has use for it. This box should be made of matched material, with a door that may be fastened tightly so as to allow none of the gas to escape. It is a prime necessity that the box be tight. It may either be painted on the inside, or papered carefully to cover all cracks that may remain. Put a little extra care upon making this box. It will repay you in time and in the success of your projects. When this is ready your wood may be treated preparatory to fuming.

27. Preparing the Wood for Fuming.—Many writers of texts on staining fail to take into account the great difference between the facility of fuming English and Dantzig oaks and the difficulty sometimes experienced in fuming our American oaks. They advise placing the wood, untreated in any way, in the fuming-box. This may give good results; on the other hand it may give no results at all. The whole process of fuming—and

this is the reason why oak lends itself particularly to this treatment—depends upon the amount of tannic acid there is in the wood. It is the chemical reaction of the ammonia and this acid which colors the wood. But our American oaks, for the most part, do not seem to have the large amount of acid that the English oaks contain. Consequently the process is slower. In order, then, to hasten the reaction, many wood-finishers apply to their wood a solution of about three tablespoonfuls of tannic acid and a similar quantity of pyrogallic acid dissolved in a quart of hot water. This solution is applied to the wood and allowed to dry. The wood is then rubbed down lightly with fine sandpaper, and placed in the fuming-box. The tannic acid is also a great aid in securing a uniform color to the wood, as well as in giving a darker shade to it in a shorter time than if it were untreated.

28. **Ammonia.**—The ammonia used must be of full strength (specific gravity .880). Pour the ammonia into several dishes, preferably flat like sauce dishes, and set them in different places in the box so that all your work will be readily accessible to the fumes. Remember that these fumes are poisonous. For this reason the box should be placed in another room from that in which people are working. The room in which the box is placed should be kept very warm, as heat makes the evaporation of the ammonia more rapid, and shortens the time of the process. The darkness of the color depends upon the length of time that the wood is subjected to the fumes.

29. **Testing the Fuming Process.**—It is, of course, necessary that one be able to get some idea, from time

to time, of how the wood is coloring. The easiest way to do this is to have a one-inch hole bored in the side of the fuming-box. When the piece of furniture is placed in the box, make a plug of the same wood (this should fit the hole tightly) as that of the piece, and push it into the hole, so that it protrudes half a foot into the box. The action of the ammonia fumes will produce the same effect upon the plug as they do upon the wood inside. This plug may be removed at intervals of time to see how the work is progressing. The plug must, of course, be treated with the tannic acid solution exactly as the piece of woodwork was. The wood may remain in the fuming-box from six to forty-eight hours, depending upon the effectiveness of the chemical action, and the shade desired.

30. Matching Color in Fuming.—It is not often possible to make a large piece of work out of the lumber from a single log. This was the way of the old cabinet-makers, but we are usually obliged to resort to artificial means to match and imitate the woods in hand. Frequently we are obliged to make flat pieces, such as table-tops, out of pieces of wood of different color, porousness, and density of fiber. Of course the ammonia fumes will not have the same effect upon all of these. The more porous pieces will be darker than the other, the lighter pieces will probably remain lighter. Many manners of matching these could be suggested, but the following will prove most satisfactory. If, after taking the wood from the fuming-box, different colors are noticeable, coat the dark portions of the wood with thin shellac. Allow this twenty minutes to dry and replace the article in the box. The fumes will

darken the parts uncovered with shellac, while those which have been covered will, of course, remain unchanged.

But if, for example, we have a table top in which there is only one small dark strip, unless we wished the work to be very dark we shall be forced to bleach out the strip to match the rest of the wood. To do this, make a bleaching solution of two or three ounces of oxalic acid dissolved in a pint of hot water. *Do not put solution in metal dish.* Paint the dark portion carefully with an old brush dipped in the liquid, and allow it some time to "lighten up." If the result is still not light enough, repeat the application. When the wood has been matched, neutralize the solution in order to keep it from bleaching the wood further, by rubbing the work with a cloth dipped in vinegar.

Another method of matching the color is to use a very weak water stain on the light parts after the wood has been fumed. The bichromate of potash solution, mentioned under *Formulas for Stains,* Sec. 24, will do this very well. The stain must, of course, be considerably weaker, and must be applied carefully with a small, soft brush to avoid overlapping upon the parts that are already sufficiently dark.

31. Oiling.—After the oak has been fumed it may be given a coat of raw linseed oil. This oil has a pleasant darkening effect upon the wood. It brings out the more compact parts, and darkens the more porous. The oil should first be heated almost to a boiling point and scrubbed into the surface of the oak with a cloth. It is not so much the quantity of oil applied—altho there should never be much—as it is the manner and

thoroness with which it is applied to the wood. It is perhaps well to add at this time that fumed oak is very seldom filled after the oiling. The best effect may be obtained by leaving the wood open, and finishing it with a wax polish. A coat or two of thin orange shellac should be applied to the wood after it is oiled. This is best done with a brush. The surface is then carefully rubbed down with fine sandpaper (No. 00), and five or six coats of brown or white wax applied. Other chemical stains will be considered under special treatment of woods.

32. Imitation Fumed Oak.—The process of imitating fumed oak may be done in several ways. There are many commercial stains for the purpose, or, if these are not readily obtainable, several coats of strong ammonia will accomplish the result. If ammonia is to be applied in liquid form to the wood, a preliminary treatment with a tannic and pyrogallic acid solution is suggested. This will make a much better color than the ammonia alone. *Ammonia should be applied in the open air as its fumes are very poisonous.* It must be remembered that this process of imitation is not to be compared with the real process of fuming. It is an imitation, and rather a poor one at that. There is really no way to counterfeit the result of actual fuming, and the student or workman should resort to the imitation only when it is necessary to do so.

CHAPTER III

Fillers

33. Use of Fillers.—Filling the pores of wood has for some time taken the place of the slower and more expensive method of making a smooth surface by successive coats of varnish or shellac. Fillers also are used to gain different effects in woods where they are colored in shades different from that of the natural color of the wood itself. In the beginning, however, it is perhaps well to lay down a few rules for the use of fillers which will guide the beginner until he has had sufficient experience to make them for himself. In the first place, the filler should be of the same color as, or slightly darker than, the stained or unstained wood. Try to match the color as accurately as possible by first testing its effect upon a block which has been stained and treated like the work in hand. This will avoid a great deal of trouble in coloring. Do not experiment with fillers until you have done quite a few pieces of work, and have seen the results of those which are recommended.

34. Two Classes of Fillers.—Wood fillers are generally of two classes: first, those which are used on open-grained woods; second, those which are used on close-grained woods. The amateur may be nonplussed with regard to such woods as birch, cherry, and maple, for these are surely hardwoods, yet they are close-grained. For convenience then we shall put down the different woods in two lists, according to the filler they

take best. The student need not take these lists as arbitrary. Indeed, the hard, close-grained woods are sometimes treated with one kind of filler, sometimes with the other. The best results, however, will be had if he follows the treatment suggested below.

35. **Woods That Require Paste Filler.**—The following woods may be most successfully filled with a paste filler: Ash, beech, butternut (white walnut), black walnut, circassian walnut, elm, mahogany, oak, rosewood and redwood.

36. **Paste Fillers.**—There are many good paste fillers to be bought in uncolored or colored forms. They are usually sold in an uncolored state so that the workman may thin them out to a correct consistency with turpentine or benzine and add the amount of oil coloring necessary to match his wood. Besides these, there are almost an unlimited number of recipes for paste fillers suggested by experts in wood-finishing. It is useless, in a manual of this kind, to burden the amateur with pages of such recipes. They will only confuse him and indeed not add materially to his knowledge. We shall suggest two fillers which have proved best for all work of this kind.

37. **Preparing Fillers.**—It is well for the student to have some practice in making his own filling compound. Mix together one part of brown japan and two parts of good boiled linseed oil. (The oil must be of the best quality if good results are to be had from varnishing.) Add to this sufficient silex (finest ground or floated) to make a paste. If the wood is to be finished in the natural color, this paste may be thinned with turpentine to the consistency of thick cream. If the wood

has been stained, add sufficient oil coloring to match the color of the wood. Remember that the coloring does not add any adhesive qualities to the filler, and

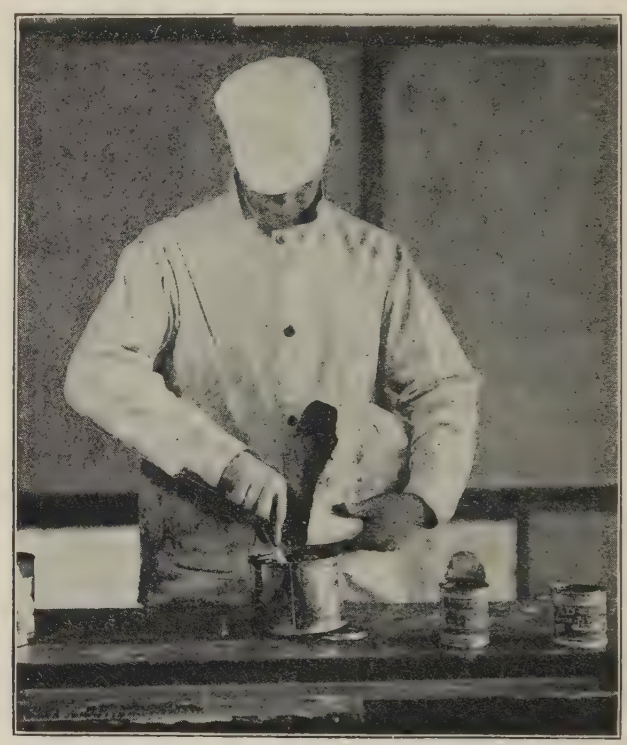

FIG. 6. Mixing filler.

that the less of it that is used the better the filler will be. If the oil coloring used is already mixed in oil, like that sold in tubes, an equal amount of the first ingredient (boiled linseed oil) must be omitted. Because the wood darkens a trifle as it ages it is perhaps better

to make the filler a little darker than the stain. This colored paste may be thinned with turpentine to a good creamy consistency, neither watery, *nor too heavy.* In the extremely open-grained woods, such as oak and ash, the filler is better made rather thick. In the close-grained woods, such as beech, the filler must be quite thin, just a little above the watery stage. The student will learn best from experience what consistency is best adapted to the woods which he uses. The silex used in this recipe is the best known base for a filler. This filler should be prepared several hours in advance of its use.

Another good filler may be prepared in the following manner: Mix together thoroly in a pestle or some convenient dish two parts of *pure* raw linseed oil (much of the linseed oil now on the market is heavily adulterated) two parts of best coach japan, sufficient finely powdered silica to form a stiff paste, oil coloring pigment to match. Thin this down with turpentine to the required consistency. This filler is cheaper than the former, and is very practicable for oak and ash.

38. **Colors Suitable for Paste Fillers.**—The following colors are best adapted to producing different shades of paste filler to match those of the stains you have used. The same pigments may be used in coloring liquid fillers if they have an oil or varnish base.

Ash. For a light color use little or no coloring in the filler. If a dark shade of brown is wished, color the paste with burnt umber.

Cherry, maple, birch, beech. Use no special filler at all. Give the wood two coats of thin orange or white

shellac, or if a deeper color is desired color the shellac with a little spirit analine which may be had in many shades.

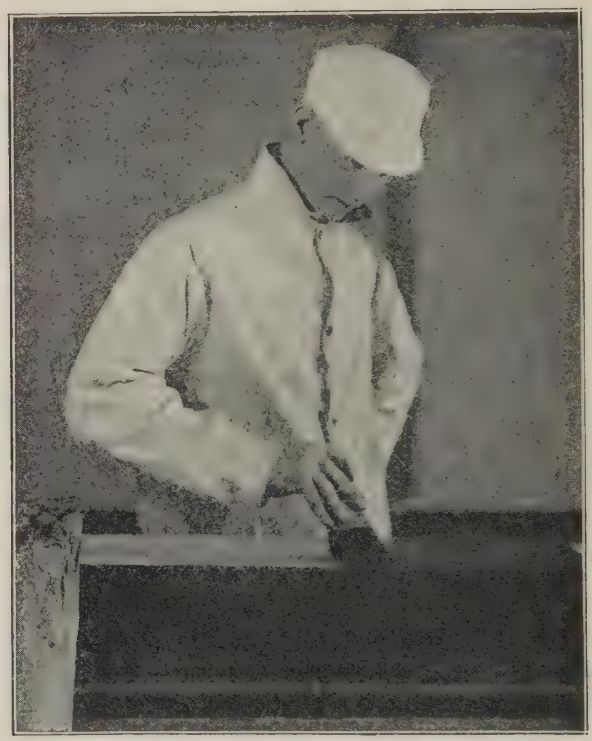

Fig. 7. Applying filler.

Mahogany. It is strongly advised that a *very thin* coating of shellac be applied to mahogany before the filler is used on the wood. This will insure a more nearly even color to the work. Van Dyke brown, drop black (this is better than lamp black, but the latter will

do in an emergency), and a little rose pink should be added to the paste.

Oak. Altho oak is often unfilled, several effects of unique color are dependent upon the filler for their

FIG. 8. Rubbing off paste filler.

peculiarity. These will be considered under the special treatment of oak, Sec. 118.

39. Applying the Filler.—Paste fillers, except in unusual contingencies, should be applied with a stiff brush across the grain of the wood, Fig. 7, immediately over the thin shellac coat that was put on to set the

color of the stain. The filler should be brushed well into the pores of the wood, so as to replace the air that is in them with the pigment of the filler. The filler should then be allowed to "flatten," that is, to become dull. This usually requires from fifteen to twenty minutes. It must then be wiped off with a piece of rough cloth, Fig. 8 (burlap is commonly used), *across the grain of the wood.* This wiping across the grain is essential so that the filler will not be taken out of the pores. Do not wipe with the grain. Be sure that none of the filler is allowed to remain on the surface or it will give a muddy appearance to the finished product. For a final wiping a piece of cotton waste is recommended.

The pores of the wood should now be well filled with the color. Silex is composed of very tiny crystals, very sharp, which hold their place in the pores better than any other substance. If, however, the filler is too thick, or is allowed to become too dry before it is wiped off, these crystals may be pulled from their place. The filler should not "pull" heavily when it is being wiped off. I know that many furniture polishers will shake their heads at this. Neither should the filler be so thin that it is forced from the pores by the cloth. Inspect your work carefully, after you have rubbed off the filler, to see that the wood does not show tiny pinholes. If it does, allow the first coat of filler twenty-four hours to dry, then apply a second coat, treating it as before. Do not use a cloth that allows lint to remain on the surface. The whole work should be allowed twenty-four hours to dry. The surface may then be rubbed down with No. 00 sandpaper.

Perhaps the commonest difficulty that will be en-

countered by the student is in removing the excess filler from corners of the work. The best method of doing this is with a sharp stick covered with cloth. Remember that all the filler must be removed from the surface and corners or your finish will appear patchy and unsightly.

Maple, cherry, and white pine may be stained and allowed to dry. They may then be filled very easily and well with one or two coats of very thin white or brown shellac, depending upon the color of the stain. The reason that this manner of filling is suggested for these woods is that they are very close grained. Shellac, too, does not cloud the brilliancy or *depth* in woods that have been stained, a very important consideration in recommending a filler. The shellac should be rubbed down to a dull, even surface. The wood is then ready for wax, varnish, or French polish finishing.

40. Rubbing Down Filler.—A few words should be said about the rubbing down of paste filler. Remember that the purpose of this filler is to seal the pores and to present an absolutely level surface to the finish which is to follow. If then this filler is not rubbed well the surface is in worse condition to receive the final polish than if it had not been filled at all. For if the wood had not been filled it would have been level except for the pores. A poor filler, or one which has not been well rubbed down, leaves not only the pores inadequately filled but also a ridgey surface upon which it will be extremely difficult to make an artistic finish. Time is always well spent upon producing the right kind of surface upon which to build your polish.

The best way to use sandpaper to rub down either

filler or varnish is directly on the hand. Never use a coarser grade of paper than No. 1; if it is a fine piece of work use No. 0 or 00 paper. Rub *in the direction of the grain,* not across it. Do not use oil on the sandpaper if a varnish finish is to be applied. Do not bear very heavily upon the paper or the sand will abrade the filler too much. If the filler is shellac, it should rub off in a white dust. If another kind of filler has been used, it should come off in powdered form. Dark spots on the sandpaper mean either that you are bearing down too hard in rubbing, or that the filler is not sufficiently dry to rub. Do not apply a paste filler to surface larger than you can take care of in rubbing off.

41. Woods upon Which a Liquid Filler Should Be Used.—Maple, pine, whitewood, poplar, basswood, ebony, cypress, and gum are close-grained woods which should be treated with liquid filler.

42. Liquid Fillers.—As in the case of the open-grained woods there were almost innumerable paste fillers, so with the close-grained woods it would be almost hopeless and indeed a valueless task to try to enumerate all the liquid fillers that are used. Each painter or finisher has his pet formulas which he will swear by, and deny the merits of all others. It will be well to devote a paragraph of explanation with regard to liquid fillers.

This class of filler is used, for the most part, on close-grained woods. Its purpose, like the paste filler, is to make a hard smooth surface upon which to put the finish. Close-grained woods may, of course, be filled with successive applications of varnish, each coat

rubbed down well with fine sandpaper. But in most cases this older method is too slow. Then further, if the wood is to be finished in the natural color, varnish (other than Damar) will usually discolor it. Especially is this true with regard to cedar chests. Many times I have seen excellently constructed chests, really made eyesores because a so-called clear varnish had been applied directly to the wood. The varnish was, of course, the only filler and finish used. There are two reasons for this: in the first place ordinary *clear* varnish is not really clear at all, but has quite a brown shade. Test it for yourself by pouring a little from one can into another, letting the stream fall between you and a window. Again, varnish contains a great deal of oil. This, on light-colored woods, turns a greyish brown which is very displeasing. On dark, or stained woods, the varnish filler may be used with good results. But on the light woods, especially on maple, pine, birch, that are to be finished in their natural shade, do not use a varnish filler, or apply varnish directly to the wood. I have made the exception of the pure Damar varnishes to this rule. They are entirely without color, but they often dry very slowly. An excellent varnish filler may be made by adding about half a pound of finely powdered silica to two quarts of good varnish. If this does not flow quite freely from the brush, add a little more varnish. A liquid filler should flow as easily as varnish to do its work well. Allow this forty-eight hours to dry, and then rub down to a smooth surface.

43. Shellac As a Liquid Filler.—Personally I am greatly in favor of pure white shellac as a liquid filler.

This should be quite thin for ordinary close-grained wood. The shellac which is bought in a prepared state is too thick for good work. It should be thinned by adding about as much denatured alcohol as you have of the prepared shellac. If one coat does not fill the grain—and it seldom does,—rub down well and apply a second coat. Shellac dries quite rapidly, so that five or six hours will usually be sufficient to allow a coat to dry. Moreover it has all the advantages of any other liquid filler with none of the disadvantages. It makes a very hard surface and seals the pores of the wood well. It does not cloud the stain or make the color muddy. In any case shellac is most frequently used as a surfacer, that is, a coat applied after the filler is used. This is true in the case of paste fillers and of liquid fillers. The open-grained woods would, of course, require too many coats of shellac to make the latter a practicable filler. But in the case of the close-grained woods, ordinarily two or three coats of shellac will accomplish both the purposes of a *filler* and a *surfacer*. We are thus able often to accomplish two things with the same operation, and in the best manner. In saying this I am aware that many wood-finishers declare that shellac is not a good surfacer to use under varnish. I have never seen an illustration of an undesirable result which could not be traced definitely to some other cause than that of a shellac surfacer. Sometimes the shellac has been applied too thick, but more often it has not been well rubbed down. Occasionally, too, a very poor grade of varnish has been used over the shellac, and has "crawled." Some painters have shown me examples of varnishing that had, as they said, cracked

because of the use of shellac under it. I cannot credit this statement. I should rather think that there had been too little oil used in the varnish, and that thus to hasten the process of drying the varnisher had rendered his varnish brittle. Cheap oils and resins are the cause of most varnish cracking within a few years. But varnish at its best is often unsatisfactory. For all general needs the student may use thin shellac as a filler and surfacer for close-grained woods.

44. Filling Wood to Withstand Weather.—It must be remembered, however, that shellac will not do as a filler or finish for work that will be exposed to the weather. Shellac rapidly disintegrates after it has become damp. All exterior work such as the outside of doors and porch furniture, should be filled with a good linseed oil filler. This filler may be made by mixing enough silica into any good varnish to form a thin paste. Dilute this mixture with a quantity of turpentine sufficient to make of it a good flowing consistency. Apply one or two coats of this, giving each coat ample time to dry, and rubbing each coat down with a fine sandpaper. Finish the work with a good quality of *spar varnish.* This will withstand almost any kind of weather. I may add that if the work is stained dark it will be well to add a little *oil stain* of a suitable color to match the color of the stain.

Exposed work of *open-grained wood* will be treated with a good *oil paste filler,* such as has been suggested in Sec. 37 and 38, and finished with several coats of good spar varnish. In this book I am endeavoring to treat of the best ways of finishing wood. I have purposely omitted many cheaper recipes that would be

added were this work intended for artisans and furniture makers. It appears to me, however, that the amateur will not do a great deal of wood-finishing, and that when he wishes to spend the time and money to do the work himself, he will wish to take every advantage of good products. The varying cost between good materials and poor materials is usually small when it is compared with the value of the person's time, while in cheap furniture houses a few cents difference in the price of a pound of filler or a quart of varnish soon amounts to a tremendous item.

CHAPTER IV

Varnishing and Polishing

45. Possibilities for the Amateur.—Thus far we have taken up three steps in wood-finishing: preparing the wood surface, staining, and filling. These have been considered in the order in which they naturally come in finishing woodwork. The next step, and the final one, is that of varnishing or polishing. No book, however comprehensive, can take into account the almost innumerable peculiar little conditions which may arise in any of these processes, much less a simple text of this kind. A little reasoning and experimentation will do wonders in making the amateur careful and efficient. For wood-finishing is not a mystic art, unapproachable except to the elect. Moreover it will be seldom, very seldom, that the student will wish to undertake any large piece of very fine finishing such as a piano. This kind of work belongs properly to the expert who has at hand all the equipment to carry out long difficult processes of this kind. But why should not any one be able to finish or refinish chairs, tables, interior woodwork, and small pieces of furniture to his taste and at his convenience? The cost which is paid for labor to do this is high, beyond the means of many of us who wish occasionally to change the appearance of some of our surroundings. Any man or woman who is willing to read the principles of wood-finishing, and to do his work carefully, step by step, may obtain excellent results, results which are often better than those

which many slipshod and careless painters and decorators charge high rates for.

46. Appropriateness of Finish.—After we have stained and filled our piece of work so that a good surface is effected, we must next choose the kind of finish that we wish it to present. This, I am sorry to say, resolves itself, for most people, into the operation of varnishing. In reality, however, there are four ways, exclusive of painting and enameling, and many varieties of each one of these: varnishing, wax-polishing, oil-polishing, and French-polishing. In selecting the kind of finish that we are to apply to the wood, we must consider the advantages of each and the needs of the piece of work. Obviously it is a waste of time to use an ordinary copal varnish upon a table top where water and hot liquids are constantly being spilled. So would a French polish be equally out of place. A spar varnish may, of course, be used, or, with equal propriety, wax or oil polish. But perhaps again the wax polish might be eliminated because it would not match the rest of the furniture which has been highly varnished. Waxed work is rarely *filled*, and so the piece might demand another kind of treatment. On the other hand, it would ordinarily be out of all economy of expenditure in time and money to attempt to French-polish or oil-polish large surfaces such as doors and other interior woodwork. We must adapt our finish to the needs which the piece is meant to serve, and to the time and expense which it merits.

47. What We May Expect of a Finish.—In this country we have so long been accustomed to the highly polished mirror-like surfaces of pieces of furniture,

that we have almost mentally set a standard for the evaluation of all finishes with this as a criterion. This is entirely wrong. There is today too much highly polished furniture. The top of a table should not reflect one's face. That is the purpose of a mirror. Glistening finishes rob the wood of its beauty, and deprive the observer of its enjoyment except he approach it from some angle where it does not reflect light. The polish of a piece of wood should not hide the beauty of the wood, but should enhance it. How often have you gone into a room where the furniture seemed to rise up and hit you as soon as you have entered. That is of course bad taste, for it violates the artistic purpose of wood-finishing. Furniture should be subdued and soft in tone. It should never make itself obtrusive. One need only compare some of our modern glistening pieces with some of the better class of soft velvety finishes to assure himself of the difference. If furniture is noticeable, its artistic quality is usually to be questioned. Do not misunderstand me in this. Varnish is a very good finish. It often serves purposes which no other finish would do. But of late years it seems to be considerably overworked. Whenever varnish is used on furniture it should be "flattened" (deprived of its shininess) in some way. Wood-finishes have two functions: to protect and to beautify wood. Whenever they go beyond this and seek to exist for their own sakes, their value is questionable.

48. Varnish.—Varnish is the commonest of wood finishes. It is composed of gum, oil, and solvent, with usually a drier. The gum is really the hardened sap

of prehistoric trees. There are almost innumerable grades in the qualities of gums, and upon the excellence of this part of the varnish its worth mainly depends. The oil used is usually linseed oil, or in the case of the "Chinamels," Chinese wood oil. A great deal of adulterated oils have been sold in varnishes to the public. Mineral oils and fish oils seem to have been used most extensively. These oils are slow drying, indeed they often refuse to dry at all. Under certain temperatures they will become "tacky," and many people find out to their sorrow that the manufacturer has not played fair with them. Turpentine is the commonest solvent. The ingredients in varnishes act in the following way: the gum gives hardness but brittleness, the oil elasticity and strength. These two unite and harden by oxidation to form a covering which is hard in proportion to the amount of gum and elastic in proportion to the amount of oil used. The turpentine merely dissolves the mixture to ensure "easy flowing" qualities. The drier is used to hasten the hardening of the varnish. From this will be seen the principal difference between exterior and interior varnishes. The brittle varnish would not do to withstand different climatic changes, for varnish must adapt itself to the varying changes in the expansion and contraction of wood. An exterior varnish will then be, of necessity, high (or "long") in oil. The opposite is true of an interior varnish. The changes in temperature are not so pronounced; the public demands lustre in interior finishes, a quality which the gum gives. These are, for this reason, "short" in oil, more lustrous, and more brittle than the exterior varnishes.

"Spar" varnishes, or those which resist the action of water, are unusually high in resinous gums.

49. Conditions for Varnishing.—Much of the success in varnishing is due to correct and suitable conditions. Where a fine finish is desired, the work to be varnished should not be cold. The ideal condition for varnishing is a temperature of from seventy to seventy-five degrees Fahrenheit. The day should not be extremely damp nor extremely dry. The varnish should be of the temperature of the room and the wood. The principle is, of course, that oils become thicker in a cold temperature. The varnish should flow well under the brush so that a great deal of brushing to even the coat will not be necessary. Everything should be as nearly free from dust as it is possible to have it. Wood should not be dusted in the finishing room. If possible, the floor may be sprinkled with water the night before varnishing is to be done so as to settle any dust. Another necessity, and one which is most frequently disregarded by workmen, is a constant circulation of oxygen. Remember that varnish does not literally dry, it *oxidizes* or takes oxygen from the air in hardening, giving off fumes. If the oxygen becomes exhausted the varnish stops oxidizing and hardening, and many ill effects may be produced. Air, while it should be circulating freely, should not blow directly upon the work. The room for varnishing should not be very light. On no account let newly varnished work come under the direct rays of the sun or it will be blistered.

50. The Brush.—The care of the brush used in varnishing is of great importance. It does not matter how

carefully and well you have done the previous work, if your brush is not in good condition the result will be unsatisfactory. The size of the brush should be that which is best adapted to the work you have to do. No amount of care will produce a smooth surface on a large table top if a three-quarter inch brush is used. There will be too much overlapping, and the work will dry in ridges. A three-inch rubber-set brush of good, thick quality and long soft hair will serve your purposes best upon large surfaces. A smaller brush will be necessary for more minute work. Do not presume that a brush is free from dirt just because it is new. Just the opposite is true. Any new brush will have to be washed well in warm (not hot) water, and allowed to dry before it is used. If possible, allow the brush to hang in water or turpentine over night before using it. This will *set* the bristles so that they will not fall out when you are varnishing. On no account begin to varnish with a brush which is still moist with water or turpentine. If an old brush is to be used, unless you are certain that it contains no dirt or dust, wash it out well in turpentine. This will "cut" the old varnish or paint from the bristles. Turpentine, however, will not cut shellac. If the brush has been used in shellac, it will have to be cleaned with alcohol. In cleaning the brush be sure to wash off the upper part in which the bristles are set. This will prevent particles of dirt from getting into your work. You cannot be too careful in this, for even under the most favorable circumstances specks of dust will occasionally show in the surface that has been varnished. A small (one quart) varnish can is an excellent container in which to keep

a varnish brush after it has been used. Cut down the handle of the brush until it is round, punch a hole in the top of the can and force the handle of the brush tightly into it just far enough so that the bristles of the brush *will not touch the bottom of the can* when the lid is replaced, Fig. 9. The best mixture in which to keep varnish brushes is a thin varnish (varnish diluted with equal amount of turpentine). This will always keep your brush in good condition, the friction lid and tightly plugged hole will exclude dust and keep the turpentine from evaporating. Good varnish brushes are very expensive, and any small precaution of the kind suggested will pay many times over in money as well as in satisfaction. How many times have I seen practically new brushes, that have cost three or four dollars, allowed to harden and become worthless by being left about on tables or thrown with dusty trash. It would require hours of work to get these brushes into a serviceable condition again, and in all probability they would never resume their value unimpaired. It is almost as bad to throw brushes into an open can containing turpentine. Dust will always collect in the can, and the bristles which are allowed to rest on the bottom of the container

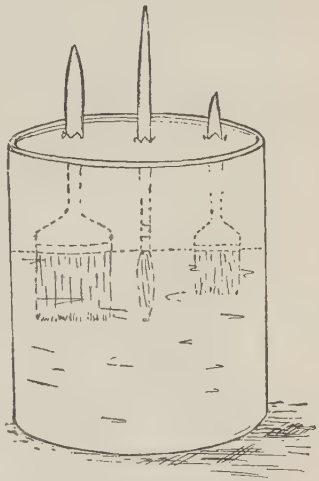

Fig. 9. A container for keeping brushes.

collect sediment, and from the weight of the brush, become bent and out of shape for any creditable kind of work. Then the student and the instructor wonder why it is that they cannot obtain good finishes on their

FIG. 10. The first process in varnishing—putting the varnish toward the middle and working it out toward the edges.

wood, and blame the result upon inexperience. It is inexperience, but not of the kind they think. If they could once see the care which is exercised by experts in such matters they would gain an entirely new point of view.

51. Varnishing.—The actual process of varnishing is not in itself difficult. The excellence of the result

FIG. 11. The second process in varnishing—cross-firing or working the varnish across the grain.

is for the most part dependent upon a common-sense knowledge of the principles of it, and care in carrying them out. For all ordinary work, three or four coats

of varnish should be enough. But if the wood has been inadequately filled, or insufficiently rubbed down to a smooth surface, other coats will be required, much to the detriment of the finish. The principle of this is, of course, that the more coats of varnish that are applied, the more quickly will the surface "check" and crack. The object in varnishing is to put as little varnish on a piece of work as possible to produce a smooth finish. Of course one or two coats will very seldom do this. Four coats seem to form a medium between too many and too few. It is clear, too, that the equivalent of one of these coats will be rubbed off in subsequent smoothing. The first coat of varnish should be a little thinner than the other coats to enable it to adhere more closely to the shellac surfacer. This may be accomplished by adding a small amount of the best quality of turpentine (not more than one part of turpentine to three of varnish) and mixing the ingredients well. Just enough varnish for the work in hand should be poured from the large can into an open dish. If the brush is frequently dipped and re-dipped into the can containing the varnish supply, a great deal of sediment is dropped into it, and it soon becomes foul and unfit for use. Never pour back into the supply can any varnish that may remain in the dish that you have been using. The first coat of varnish, being quite thin, will flow out from under the brush almost like water. Very little brushing will be necessary. Indeed, the less brushing the better, for air bubbles will arise from too much working of the varnish. The brush should not be dripping with varnish, but it should be well filled. Apply the varnish, where it is possible, with

long firm strokes. Work rapidly. Remove any hairs that may fall out of the brush with a thin bladed knife. The more quickly you can get this coat on the better will it flow and level itself. When the most of the varnish has flowed from the brush, take up any excess varnish from the lower corners of the work. Allow this coat fully forty-eight hours to dry. The first difficulty in amateur varnishing will be that he will not be willing to allow this coat sufficient time to become thoroly hard. The fact that the surface feels firm to the touch is no indication that it is ready for rubbing. The surface oxidizes first, but the part underneath much more slowly. As a rule, no kind of satisfactory work may be accomplished if each coat is not allowed to become hard thruout. I know that this rule is sometime violated by painters and finishers for the sake of saving time, but it is not time well saved. If the varnish is not quite dry it will come off in small black spots on the sandpaper. If subsequent coats are applied, each coat will have to become thoroly dry before the under coat resumes its process of oxidation. Varnish that is worth applying to wood should not dry to a rubbing surface in less than forty-eight hours. If it does, there is probably an excess of gum and too little oil for a permanent finish, or it may have been adulterated with driers to such a degree that its serviceability is seriously impaired. For this reason spirit varnishes (those which are dissolved in alcohol) should not be used. This, of course, does not include shellac, which is an entirely different gum.

52. Rubbing Down the First Coat.—If four coats of varnish are to be applied, the first one may be rubbed

down with fine sandpaper, No. 00, Fig. 12. The paper may be softened by putting a little oil *on the back of it,* or it may be split if it is a good quality. The reason of this is to prevent a stiff surface from coming in contact

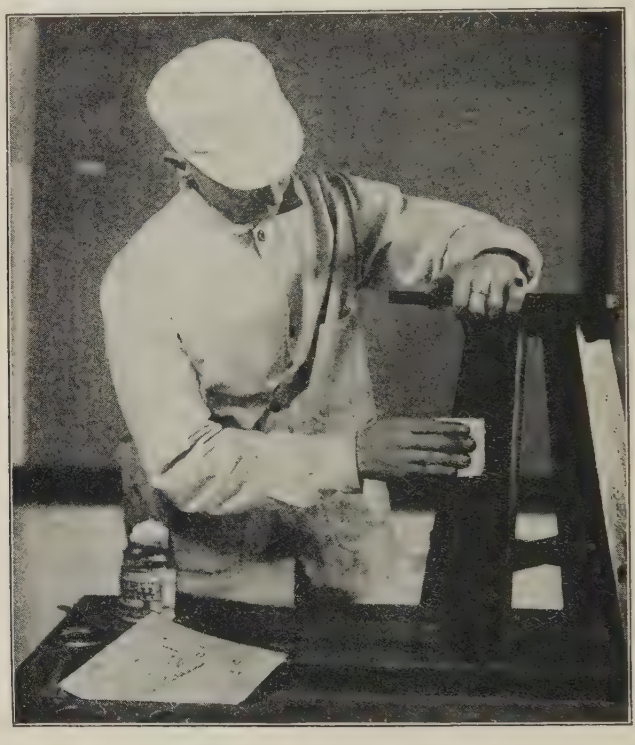

Fig. 12. Rubbing down the first coat of varnish.

with the varnish. For this reason also the sandpaper should be held on the tips of the fingers, not placed on a block as in smoothing wood. Rub the surface lightly in the direction of the grain, *not across it.* Look at the paper occasionally to see that no black spots appear

on its surface. If you find these you are either pressing too hard on the sandpaper, or the varnish is not dry enough to be rubbed. If the work is not dry enough, do not continue the rubbing. It can give you nothing but dissatisfaction. Put it back in the finishing room and allow it to dry.

53. The Second and Third Coats of Varnish.—These coats may be applied to the wood without being thinned with turpentine. They should not be so thick that they will not flow evenly from the brush. See that your work is very carefully dusted to remove all dirt that may remain from the sandpapering. A soft cloth, free from lint, just moistened in turpentine will do this admirably. Be sure that this cloth is not wet with turpentine or it may soften your first coat of varnish. The object of these second and third coats of varnish is to make an entirely smooth surface for the last or polishing coat. Each of these must be thoroly dry before the next is applied. This is absolutely essential. Never should any rubbing be done sooner than in seventy-two hours. Even a longer time is advisable. Remember that varnish in reality *dries for months.* These coats of varnish should be rubbed down with pumice stone and water, or with pumice stone and oil.

54. Rubbing with Pumice Stone.—Even the finest of sand paper is too coarse to produce a finely polished surface. For this reason pumice stone, a pulverized rock, the minute crystals of which have very fine cutting edges, is used. Pumice stone may be bought in different degrees of fineness. A medium coarse stone, No. F, may be used for rubbing down the second coat of varnish, but the third should be rubbed with No.

FFF. It is well always to sift the pumice stone thru two thicknesses of cheese cloth before using it. This will take out any large crystals which would in-

FIG. 13. Rubbing final coat with pumice stone and oil.

jure the surface of the varnish. Another and an easier method of accomplishing the same result is to tie up some pumice stone in a handkerchief and pounce it on the surface as may be required. The rubbing of a surface with pumice stone is done in the following manner:

Obtain a good soft piece of harness-maker's felt, about three inches wide and five inches long, Fig. 13. Moisten the surface of this with water or raw linseed oil (water will enable the pumice stone to cut more quickly, but oil will produce a finer finish), and rub gently over the varnish upon which pumice stone has been lightly sifted. Increase the pressure upon the rubber gradually, and *rub with a circular motion,* covering all the work as many times as is necessary. Be careful not to rub in one place so long as to remove the coat of varnish. Look at the surface of the rubber frequently to see that it is not caked with hardened pumice stone and water. This must always be removed before the rubbing is resumed or it will scratch your work. If the surface cakes frequently use a little more water or oil. Excellent results may be had by using water as a solvent for the second rubbing mixture and oil for the third. When the surface has been brought to a perfectly smooth dull finish, remove the pumice mixture with a cloth moistened with raw linseed oil. Remove all greasiness with a dry cloth and allow the varnish several hours in which to dry thoroly. It will then be ready for the last or polishing coat.

55. The Use of Steel Wool.—Steel wool should not be used where a fine finish is desired. Many furniture refinishing shops use it to save time, but the result is sure to be unsatisfactory. Steel wool cuts very rapidly, but it also cuts unevenly. A small tuft of steel wool in the hand will cut all surfaces alike, the low places in the varnish as well as the high places, so that when you have finished rubbing the work is really in about the same condition as it was when you started.

The felt pad used in rubbing with pumice stone exerts more pressure upon the high points than upon the low, and tends constantly to level the whole surface. Steel wool, moreover, will not cut off the tiny projecting points where dust may have settled in the varnish.

56. The Last Coat of Varnish.—It is of the most importance to have the surface of your work, *even, perfectly dry, and greaseless* before applying the final coat of varnish. This coat should be a high grade *rubbing varnish* (one which contains a high percentage of gum, in order to make a hard surface that will not be affected by water or oil, and that will take a high polish), and should be applied with the utmost care. Speed in getting the varnish on the work is necessary so that it may have as good an opportunity to flow as possible before it begins to any appreciable extent the process of oxidation. Allow this coat several days at least in which to dry. When you are sure that it is perfectly hard, clean the piece of felt that you have used before, or better still have a new piece. Sprinkle finest sifted pumice stone over the surface of your work, moisten well the surface of your rubber with water or with *sweet oil* and polish as before, taking especial care not to rub thru any part of the varnish. When the surface has been brought to a smooth dull gloss in which there are no specks or imperfections, wipe off the polishing mixture and allow the piece several hours to dry. The final polishing may be done in many ways. I shall explain only two of these, as they will be sufficient for any polishing which the amateur or even the most advanced student may wish to do.

57. Polishing with Rotten Stone.—This material does not cut so rapidly as pumice, but it is very much finer, and consequently produces a smoother surface and a higher gloss. A piece of fine felt—a piece of an old felt hat, well washed out to remove any grittiness—will do for a polisher. The rotten stone is sprinkled on the surface as the pumice stone was, the felt is moistened with sweet oil, and the polishing is begun with circular motions of the hand. Work over all surfaces carefully, looking often at the rubbing surface of the felt to see that no sediment has hardened there. The final rubbing with this polisher is done in the direction of the grain. The surface may then be cleaned thoroly, and a very little *sweet oil* rubbed over it.

Another method of rubbing with rotten stone is with the surface of the hand which has been moistened with water and a little rotten stone sifted upon it. The hand is then rubbed over the varnish with a circular motion. In this way the whole piece is rubbed with the moistened palm and finally with the dry hand. The work is then oiled with *sweet oil* and cleaned off.

58. Value of Experience.—No number of pages of suggestions for varnishing and polishing will take the place of actual experience. The first efforts of the student will not always be successful, but a little practice will help him to overcome any difficulties which may present themselves. The knowledge of the instructor, too, at different times will be of the greatest service to the novice in correcting faults and avoiding errors. It will be observed that I have omitted many kinds of varnishing which are often done on cheap

work. I have done this for two reasons: first, there are enough slipshod manners in common use now both by amateurs and professionals, and little enough good finishing; second, that if a student understands the principles of good finishing he will have no trouble in adapting them to needs of a less exacting nature. The suggestions given for finishing furniture will apply as well to interior woodwork of all kinds. Fewer coats of varnish may sometimes be used, frequently additional coats will be necessary. But whatever are the needs of the particular wood in hand, the principles are similar. Exterior surfaces will not, of course, require the care and thoroness of interior finishes. With a few remarks on one other class of varnishing, I shall take up other kinds of finishes which should receive much more attention in manual training rooms than they now do.

59. **Varnish-Staining.**—This class of varnishing is really not to be recommended for any ordinary conditions. It is a cheap attempt to accomplish coloring and staining in a single operation, and like other substitutes it is *not* "just as good." It has very little advantage over any other kind of finishing, and its disadvantages are many. In the first place it does not stain the wood at all. The whole color is retained in the coating. Whenever this is worn off or scratched the different color of the wood is visible. Varnish stains also do not bring out in a satisfactory manner the beauty and depth of the wood, but merely obscure them. On the whole it is a cheap job meant for cheap work, and should be regarded as such. Of course one may cover up a multitude of defects in this manner; he may hide

poor matching and cheap wood, or he may obscure his own faulty joints, but unless there is a sufficient reason for the use of a varnish stain, it should be barred to students. This class of finishing has a place to fill, but it is not among the better kinds of wood-finishing. Varnish stain should be applied like any other varnish, and allowed to dry thoroly. The coloring in the varnish will probably keep it from drying so completely as if it were used pure. The work may be rubbed down in the manner suggested above. For quickness in renovating the finish of pieces which are not valuable, varnish stain may be used, but the work is not of an enduring nature, and time is seldom well spent in doing it.

60. Common Faults in Varnished Surfaces.—

Blooming or white blotches. This fault will more often occur in good varnishes than with cheaper grades. It is usually caused by the presence of moisture in the wood, or in the varnish. For this reason varnish should not be stored in a cold or damp place, or left uncovered to the air when it is not in use. Blooming may sometimes be cured by bathing the part in warm water and then rubbing it briskly with a piece of fine woolen cloth; sometimes by rubbing with a piece of cloth dipped in a solution of olive oil and vinegar; but frequently the surface will have to be well rubbed down, or even removed entirely, and revarnished.

Pitting. This fault is usually caused by undue moisture in the room while the varnishing is being done, or because the varnish has been thinned with a poor grade of turpentine. The only remedy for this is to remove the varnish and do the work over.

Crawling or Creeping. This may result from greasiness on the surface that has been varnished, from varnishing over partly dried coats of varnish, or from sudden changes in the temperature. The surface is usually so uneven when this occurs that the only remedy is to rub down and revarnish.

Brush Marks. These are caused by too much brushing or by using a varnish which is too thick. Rub down the coat to an even surface; see that the varnish is of a good flowing consistency by adding, if necessary, some *good quality* turpentine; and revarnish, allowing the liquid to cover the surface as much as possible by its own spreading.

Checking. This fault is most noticeable over veneered work. It is caused by some change in the varnish or the wood underneath it and to which it is too brittle to adjust itself. It may be caused by using different kinds of varnishes over each other. Pianos often do this because the elasticity or oil part of the varnish has been sacrificed to the polish or gum part. Thus the varnish has been made too brittle. Usually veneered work shows this fault most quickly. A temporary remedy may be had by rubbing the work with a cloth moistened with linseed oil, but this is not a permanent relief for as soon as the oil dries off the surface will appear as before. It is better to rub down the surface and revarnish it.

Sweating. This is almost invariably caused by rubbing varnish before it is sufficiently dry. The presence of cheap oils may sometimes account for it. Put the work back to dry for a few days, then the rubbing may be resumed.

Imperfect Drying. We often find varnished work which remains sticky for weeks after it is used, and indeed, it may never become dry. The cause of this is probably that the varnish contains cheap mineral or fish oils which do not oxidize like linseed oil. Again the cause may be greasiness on the surface to which the varnish was applied. Varnish does not dry over grease. The only remedy is to soften the varnish with turpentine or with some commercial varnish remover, wipe it off with a cotton cloth, wash the surface with a mild solution of vinegar to prevent any darkening action of an acid in the commercial remover, and refinish. Sometimes drying may be forced by applying directly to the sticky surface a coat of terebine or other liquid drier. When this fault occurs in the pews of churches or in other public seats the fault is probably that the contractor has used a cheap varnish or that the fumes and heat from the bodies of so many people have softened the oil in the varnish. There are not many kinds of varnishes that will stand such atmospheric conditions without softening. The only remedy for this is to remove the varnish (it will not do to put a coat of good varnish over the sticky substance) and refinish the work, using a special varnish which is made for the purpose. Better still, the work may be waxed.

61. Patching Varnish.—Very often one has the problem of patching holes or large abraded parts in a varnished surface. This requires a special treatment and a great deal of care in working. The first thing to do is to cleanse the abraded portion thoroly with a fine brush moistened with turpentine. You will then

be able to see whether or not the wood needs restaining. If it does the stain should be applied in very thin or weak coats until a perfect color match is obtained. When this has had time to dry, apply a coat of varnish to the *bottom* of the worn part. *Never try to patch a hole with a single coat of varnish.* It will not be satisfactory. Give this application ample time to dry and then rub it down with pumice stone and water, *not with sandpaper,* and be careful not to rub outside the hole. Wipe off the pumice carefully, allow a few hours for the work to dry off again, and apply another coat of varnish, covering this time a little larger section than before. Treat this in the same way as the first coat, and apply a third. Successive coats of varnish, probably three or, at the most, four will be necessary to restore the surface to its original finish. The last coat should be feathered into the edge of the patch and no rubbing should be done until the new varnish is thoroly dry. Pumice stone and oil, followed by rotten stone if the surface is highly polished, will restore the finish so that the patch will not be noticeable.

CHAPTER V

Wax-Polishing

62. Use of Wax.—This form of polishing is one of the oldest and best ways of finishing wood. It is, too, perhaps the easiest of all methods. Wax-polishing, also, has many advantages over other manners of finishing. It imparts to the wood a beautiful satin luster, it brings out the grain of dark woods beautifully, and, altho it may be easily injured, it does not show scratches to such an extent as varnish or French-polish, and may be restored in the simplest manner. It seems particularly well adapted to finishing certain woods such as oak, mahogany, and walnut, and always adds the charm of antique appearance to any wood on which it is used. Wax-polishing well deserves the vogue that it is having after so many years of use, and as a manner of wood-finishing should be highly recommended to amateurs as well as to experts. It is generally used upon the three woods mentioned above, but it need not be confined to them.

63. Preparing Wax.—The wax used in polishing may be obtained from any paint and varnish shop, but if the student prefers to make his own, this may be done very easily and cheaply. Either white or brown wax may be used, depending upon the effect that the finisher is trying to obtain. The white wax fills the pores of a dark or dark-stained wood and gives a weathered effect to it. The brown wax does not show as a different color. In preparing the wax merely cut

a few ounces of bees wax or white wax into thin shavings and drop them into good turpentine. Allow this to stand over night. Upon re-examination the wax will be found to be dissolved and ready for use. The consistency of this must vary in accordance with the needs of the wood upon which it is to be used. Very open-grained woods such as oak, ash, and chestnut will be best polished with quite a stiff paste, while mahogany and walnut will need a correspondingly thinner mixture. Wax should not, however, be made very thin. It should always be in paste form. The dissolving of the wax in the turpentine may be hastened by heat, but as turpentine is a very inflammable liquid, this method should be used very carefully. Some finishers use various other ingredients in the wax, but in my opinion the advantages of these are outweighed by their disadvantages. At any rate this simple compound will prove sufficient for and give excellent results to any work upon which it is used. For the polishing of such pieces of furniture as table tops and chests it has no peer, while, not the least of its qualities which may recommend it to the novice, it is as nearly a *fool-proof* polish as can be made. Indeed, it would be difficult to imagine how any one could spoil a wax polish, or fail to get an excellent finish consistently. If the wax is desired in any particular color merely add a sufficient amount of oil analine dye to produce the shade.

64. Applying the Wax.—The easiest manner of applying wax to a surface is to wrap some of it in two layers of an old handkerchief and rub it briskly over the surface. This will distribute the wax evenly. Allow

it a few minutes to dry and then rub, first across the grain and then with the grain, with a brush or coarse cloth. Allow each coat to become hard before another is applied or time will be lost in rubbing off what has been put on. There can be no definite number of coats of wax given as a minimum or maximum. Merely rub on a sufficient number of coats to give the work a good luster, and go over it occasionally to keep it in good condition. It is customary to wax wood that *has not been filled,* but to which a coat or two of thin shellac has been applied to *set the stain.* Filled woods seem to be out of keeping with wax-polishing. Often the shellac undercoat is, for special reasons, omitted. But I shall treat of this under Chapter XI. The only things necessary to obtain an excellent wax finish are dry wood and cloth, and plenty of brisk rubbing. Three pieces of cloth are usually sufficient—one with which to apply the wax, one (or a brush) to rub in the wax, and a third to do the final polishing. The polishing may be facilitated on horizontal surfaces if a brick sewed up in quite a few layers of cloth is used as a polisher. The weight of the brick will save quite a lot of pressure from the arms and obtain as good a result with less work. In polishing carved work a brush will be necessary.

CHAPTER VI

Oil-Polishing

65. Values of Oil-Polishing.—This kind of polishing is perhaps the oldest of all attempts at wood-finishing. Oil, as has been mentioned before, has a beautiful darkening effect upon the dark hardwoods. The softer parts of the wood absorb the oil to a much greater extent than the closer grained and harder parts. Thus naturally does the oil fulfil the natural duty of a stain, viz., to bring out more prominently the natural beauty of the wood. Even where other means such as varnishing, French-polishing, or waxing are resorted to as final polishes, oil plays an important part in finishing. It is seldom used on light-colored woods for the effect is usually unpleasant. Strictly speaking, oil-polishing means the application of linseed oil to the surface of the wood and subsequent rubbing until a dull satin gloss is obtained. But there is a great deal of confusion in regard to different methods advocated to accomplish the result with a saving of time. At present no furniture company could afford to spend time in making this polish on a large scale. It is long and tedious, and people in general are little able to appreciate its value. Perhaps at some later date there may be sufficient demand for it to make the operation pay for itself, but at present only special jobs are finished in this way. For the student, or the person who makes this art his hobby, oil-polishing has a different aspect. He need not hurry in his work because he is under no

necessity to turn his product into money. For the one, then, who wishes to make something beautiful and is willing to spend the time it will take him to do it, I append this chapter.

Oil-polishing is a process which it takes years to perfect. Indeed one might say that it is never really finished, for the occasional rubbing, perhaps only once a month, which is usually given to its surface serves only to enhance its softness and to enrich its color. Oil besides being a polish is one of the best preservatives of wood. It seals every pore hermetically by filling it, and of all polishes is least affected by climatic conditions. Warm water or hot dishes do not injure it, and yet the sheeting of oil which covers the wood is so thin that it can scarcely be measured.

66. Preparing the Surface of the Wood for Oil-Polishing.—I cannot urge too strongly the necessity for a smooth surface before beginning the process of oil-polishing. The work should be gone over very critically to discover even the minutest abrasions or scratches, for these if left will show in greatly increased magnitude under the polish. All holes should be filled if possible with a *dark wax-stopping* such as has been described in Chapter I of this book. Remember that walnut turns almost black under the influence of oil, mahogany turns a rich brown, as does oak. The work may, of course be stained with any kind of stain, but in the case of walnut this will not be necessary.

67. The Oil Used.—The oil used in polishing is linseed oil, either raw or boiled. If raw oil is used dilute it with about one part of turpentine to five of the oil.

Allow this to simmer over a slow fire in an open kettle for several hours. Do not allow it to come to a boil. The boiled oil should likewise be heated before it is used. Unless you are sure of the quality of boiled oil do not use it. Most commercial boiled oil is rendered useless by adulterants.

68. Applying the Oil.—The warm oil may be applied with a brush or cloth directly to the wood. No filling is generally used, altho a good way in which to shorten the procedure of polishing is to give the work one or two coats of thin shellac (either orange or white) after two coats of the oil have been applied. The shellac should be of almost watery consistency or it will fill the pores of the wood too much. Another manner of accomplishing the same result is to go over the surface once or twice with French polish. In either case it is well to rub down the shellac to a smooth surface with No. 00 sandpaper which has been used so that its cutting edges are quite fine. A little oil on the surface of the sandpaper will help to keep it from scratching. *On no account use new sandpaper or rub across the grain* of the wood. An experiment will show the justification of this injunction. If French polish is used it may be smoothed in the manner described under the chapter treating of this kind of polish, instead of with sandpaper. Wipe off the surface grease with a cloth dampened in alcohol before applying the shellac. The object in oil-polishing is to scrub the oil into the pores of the wood. It does not require a great deal of oil on the surface at any one time. The polish is effected by rubbing or friction. First, rub across the grain briskly, then with the grain. Do not attempt

to hurry the process, but put on a few coats daily and set the work aside for a while. It is well to have other work on hand to do when you are oil-polishing. After a week of daily applications of oil and rubbing the polish should begin to appear. If it shows bright and dull spots unevenly it is probable that you have applied too much shellac in places, or that you have not rubbed down the shellac well. The way to remedy this is to take a rubber of French-polish and go over the dull spots carefully. Smooth this application with the rubber, not with sandpaper, and apply the oil as you did before. In this way the whole surface may be brought to an even gloss. Each time an application of oil is given to the surface, it should be rubbed to a dry finish before the next coat is applied. The suggestion I made in regard to wax-polishing with a brick well wrapped in coarse cloth may well be used in oil-polishing also. The only difference between polishing wax and oil is that oil requires more scrubbing and less friction than does wax. However the student will soon learn this for himself after he has attempted it a few times. I may add one other suggestion: If boiled oil is used, I mean by this the commercial boiled linseed oil, one will save time in polishing if he allows the sediment of the oil to be deposited on the surface of his work before he begins to polish. This sediment will form as a white deposit a few minutes after the boiled oil is applied to the wood. *It must immediately be rubbed off,* and in this rubbing the polish is effected. After the finish is completed, it should be rubbed over a few times a year with oil to help it retain its beauty, and to feed any pores which may have begun to open.

Furniture finished in this way has a charm that increases with age, while the polish, unlike varnish, becomes better with time.

The student should not attempt large pieces of this work to begin with. Small flat surfaces are best at first. Neither should oil-polishing be attempted over inlaid work without several coats of white shellac being given to the work to keep the oil from discoloring the light-colored woods. As a general rule, however, French-polish is much better adapted to inlaid work or marquetry than any other form of polish.

69. Lack of Luster in Oil-Polish.—This is almost invariably caused by cheap adulterated oil being used in polishing. The presence of many cheap substitutes in linseed oil has become very common of late years. These oils do not dry thoroly like pure linseed oil, and no amount of polishing will produce a finish. The only remedy for this is to dry off the surface of the wood and use good quality of oil for the remainder of the work.

CHAPTER VII

French-Polishing

70. Place for French Polishing.—In this country the art of French-polishing has been largely substituted by that of varnishing, but it still remains for certain kinds of work the height of the polisher's art. Varnishing can be done in its earlier stages by labor that is not highly skilled, but French-polish must be done thruout by experts. New methods of varnishing such as dipping and spraying with air pressure have only served to widen the gap between the two ways of wood-finishing, so that it is unusual now to see a piece of genuine French-polished work on the market. But this need not deter the student from attempting it, and, after a little experience, from obtaining quite excellent results. No number of suggestions will, without actual experience, make a French-polisher, but a detailed description of the different processes of it will help the novice to avoid many of the pitfalls into which he would otherwise stumble. French-polishing is the most difficult of all wood-finishing. At every move the amateur is apt to make a mistake which will irretrievably spoil his polish. For this reason only small pieces of flat work should be attempted at first, and several of these should be done before larger projects are begun. But the satisfying beauty of a well polished piece of work will be its own reward for the tediousness of the process.

The student should be encouraged to attempt this

manner of polishing after he has the rudiments of furniture construction well in hand. It is useless for him to spend the time and care which French-polishing requires upon a poorly made piece of woodwork. Design, construction, and finish—these go hand in hand. No one of them may be done in a slipshod manner. Yet of the three the one most commonly passed over hurriedly and carelessly is the last. This should not be true, for it matters little how good the design be drawn or the construction effected if the finishing is not well done.

French-polishing is the application of shellac by rubbing it over the wood with a specially constructed cloth called a rubber. It does not mean in any sense the application of shellac with a brush which belongs properly to the class of finishing known as spirit-varnishing. It is really done in three distinct processes: (1) filling the pores of the wood and putting on a body of polish, (2) smoothing out the polish to get rid of any early marks which the heavy polish has made, and (3) *spiriting out* with pure alcohol. I shall treat of these in the order in which they naturally come, but first let us turn our attentions to the preparatory processes.

71. The Polish.—French-polishing is done for the most part with orange or white shellac. Only upon occasion is the polish colored. While prepared shellac may be bought in convenient-sized bottles, it may be made easily, and will often give better results than the prepared compound. White or bleached shellac is difficult to make, for it involves the bleaching out of all the orange coloring by a potash or other chemical solu-

tion. It will be well, then, for the amateur to buy whatever white shellac is needed for the finishing of *natural woods.* White shellac is more apt to be adulterated than is orange shellac, and it is much more susceptible to injury from light, age, and climatic conditions. To prepare a good quality of orange shellac merely add a pint of denatured alcohol or better still, if it can be obtained, pure grain alcohol, to six ounces of shellac gum. On no account use wood alcohol for French-polishing as it will not work satisfactorily. The gum will dissolve more readily if it is broken up into small pieces. Allow this to stand in a bottle over night. The next morning the shellac will be dissolved and ready for use. The commercial prepared shellac is usually too thick for any except the initial polishing. It should be thinned with about one part of denatured or grain alcohol to three parts of the shellac, and well shaken so as to mix the extra ingredient thoroly. If you find that the shellac contains dust or dirt of any kind strain it thru a piece of clean muslin. Never allow water to enter the shellac even in the smallest amount. Do not put shellac in a metal dish, or allow the metal handle of a varnish brush to lie in it. The metal will discolor white shellac badly, and impair the color of orange shellac.

72. Source of Shellac.—Shellac is a resinous exudation which appears upon the twigs and branches of certain Southern Asiatic trees as the result of minute punctures which an insect makes in their bark in order to deposit her eggs. This substance is gathered by breaking off the twigs, and in such condition is known as *stick lac.* The lac is then dried, beaten from the

twigs and melted. It is now in the stage known as *seed-lac or grain-lac.* This is now placed in sacks and heated over a slow fire to melt it. The sacks are then twisted so as to force the lac thru the pores of the cloth and in this way to strain it. As it is strained it is allowed to flow upon clean planks, where it hardens in a caked or *shell* form. This product is now *shell lac* or shellac. Shellac is soluble in both borax and alkali solutions and spirit, but the former combination does not play any important part in wood finishing. Many other ingredients are used in commercially prepared shellac, some added to make the gum more elastic, others to cheapen the cost of the product. Shellac makes the hardest of all finishes, it does not show scratches as varnish does, and wears very much better than varnish. The finest pieces of delicate intarsiatura and marquetry are usually French-polished, because varnish would to some extent discolor the different woods used.

73. Preparing the Wood for French-Polishing.— The wood to be polished may be filled with a filler such as has been suggested in Chapter III of this book, or it may be filled with the polish itself. This latter mode is probably better unless the wood used is so open-grained that too much time will be consumed in doing it. In any event the wood must be stained and matched as well as possible before the filling is attempted. Wax-stopping is suggested to fill all holes in the wood. Altho some polishers apply a coat or two of shellac with a brush and rub these down with pumice stone and oil before beginning the French-polishing proper, this method is not to be advocated strongly. If it is used,

be sure to remove all oil from the surface of the shellac before you begin to polish. It is well, too, to have as many flat surfaces as possible. If your work is ready to be put together, polish as much of it in this state as may afterwards be glued without danger of injuring the polish.

74. The Rubber.—Shellac in French-polishing is applied with a rubber composed of an inner core which is moistened with the polish and enclosed in two layers of well-washed muslin. There is much conflicting advice concerning the correct manner of making the rubber. The way which I illustrate here is taken from J. C. S. Brough's treatise on *Staining and Polishing*. It has proved so successful as compared with other methods which I have used that I have no fear of recommending it for student as well as for expert use. First, roll up a piece of heavy cotton cloth—bed sheeting will do—into the form of a cone about three inches long, as shown in A, Fig. 14, and an inch or more in diameter at the base. Do not attempt to do this with cotton batting, as this will not retain its shape. Now double a clean, well-washed handkerchief, or other piece of muslin which is free from lint, and lay it before you, the folded edge away from you. Place the cone-shaped piece of sheeting in the center of the muslin with its point toward the folded edge and about an inch away from it. *B,* Fig. 14. Fold the edge back over the point, then bring the two sides of the outer wrapping together with a few twists, and the rubber is complete, *C* and *D,* Fig. 14. In this work do not think that any kind or shape of rubber will do. Much of the success of the polishing will be due to the care

with which the student follows these directions until he becomes sufficiently expert to change and devise ways of his own. On no account should the rubber be made by simply twisting up one piece of cloth inside another. Even an expert could not do satisfactory work with that as a tool. The rubber is held in the hand with two fingers on the point of the cone, the re-

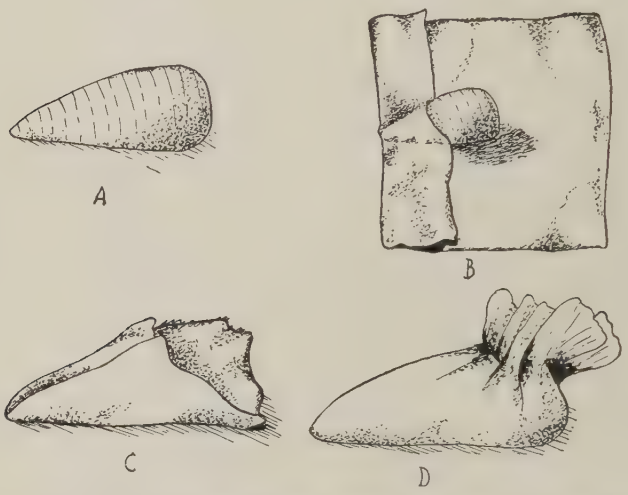

Fig. 14. Steps in making the rubber for French-polishing.

mainder grasped firmly in the palm, Fig. 15. The rubbing surface of the rubber must be entirely free from wrinkles or folds, and bound tightly across the firm inner cone. A larger rubber will be needed if large pieces of work are to be attempted, but the size suggested will be sufficient for beginning operations. At least three of these rubbers will be needed in the complete process of polishing, and if the surface of them

becomes worn, the cone must be changed so that a new rubbing surface is presented to the wood.

75. Beginning the Polishing.—If the student wishes

FIG. 15. A student applying French-polish.

to fill the wood without a special wood filler, this operation may now be begun. The cone is taken from the rubber and saturated with a medium thick shellac polish such as described earlier in the chapter. It is then replaced in the muslin and enclosed in the manner suggested. Now take some pumice stone which has

been tied up in a small cotton sack and dust it lightly over the surface of the wood. Do not use much pumice stone at a time, nor have your rubber filled with a thick polish. Either of these faults will be shown if the rubber pushes the pumice stone ahead of it, instead of forcing it into the pores of the wood. Rub the saturated rubber, beginning *lightly* on the wood, with a *circular motion*, covering the whole surface *without allowing the rubber to pause on the wood.* This is of the utmost importance, for as soon as the rubber rests on the polish it will stick. Furthermore, do not rub in the same place more than once. Keep the rubber moving from one place to another. When you have gone over the work once, allow it half an hour or more to dry. If the pores are not filled—and they will not be filled if the wood is open-grained—repeat the operation, using the pumice stone and polish as before. It may often require several coats of polish to fill a wood as open grained as walnut, while many more will be needed for oak or chestnut. Each coat should be rubbed down with very fine sandpaper after it is quite dry. This is a factor that must be borne in mind constantly when finishing with shellac: that the more coats which are applied the longer time will each coat take to dry. Thus the first application may dry sufficiently to rub within thirty minutes, but the second should be allowed to remain an hour. Do not hurry in your work. You will save a great deal of time by being sure that the shellac is completely dry before you begin to rub it. As in all rubbing with sandpaper rub in the direction of the grain of the wood, never across it. When the pores are well filled dust off any pumice that

may remain on the surface, and allow the work to stand for an hour. The surface should now be ready for polishing.

76. Bodying Up.—After the grain of the wood has been well filled with shellac and pumice stone, the next operation is to obtain a good body of polish on the work. This process involves more care than the first, for we have now an under-coat of shellac which may, at any time, be softened by the alcohol in the polish which we are using. The polish should be still quite heavy in body, almost as thick as that used in the first process. The method of applying it is similar to that which has been described, but great care must be taken lest the under-coat be picked up on the rubber. Some precautions are necessary. In the first place use a new rubber, or at least one which has not been used with pumice stone. The rubbing surface of the old one will probably be badly frayed in the first part of the polishing, and a smooth clean surface is absolutely necessary at this, as indeed at all subsequent times. Take the cone-shaped wadding from the rubber and moisten it with polish. Do not saturate it, however. Replace the exterior cloth and begin as before lightly with a good full circular sweep, taking care not to go over the path of the rubber a second time. If you do this, the rubber will probably stick in the quick-drying coat that has just been applied. If the rubber sticks accidentally to the work and pulls up a part of the finish or roughens it, do not attempt to smooth the abrasion by pressing more firmly on the rubber or by going over the surface again. Wait until the shellac in this place is thoroly dry. You will then have lit-

tle difficulty in filling the hole. I suggested that you begin with a light but firm pressure on the surface. This is necessary for the shellac in the rubber will flow easily from the rubbing surface. As the rubber loses its moisture it will be necessary to press gradually harder. At this stage of the polishing never work with a dry rubber. Stop and recharge it as often as necessary. If the shellac seems to "pick up" from the work very easily one of two faults is evident—either you are working upon a partially dried surface with too little polish on the rubber, or you have thinned the shellac with a cheap form of spirits such as wood alcohol. Before trying to determine which of these is the cause of your difficulty be sure that it is not your own carelessness in allowing the rubber to stand on the work or in rubbing over a surface which is not dry and hard. Only experience will teach the amateur just how heavily to bear upon the polishing rubber, or how much polish to use at different stages of the process, or how much the polish is "pulling" under the polisher. The first coat in this part of the work may be applied directly to the surface, and without any lubricant. As the work progresses, however, you will find that the rubber will "drag" considerably in spite of anything you may do. When you find this is happening, recharge the rubber with shellac, moisten the tip of your finger with linseed oil and put a few spots on the surface of the rubber with it. The oil will lubricate the rubbing surface and facilitate the polishing. Do this whenever the polish begins to pull. Be sure that the cause of this is not in your using too dry a rubber. The point at which the novice may fail

is that he will be inclined to use too much oil on the rubber. Remember that oil has no place in French-polish—even though many writers on the subject seem to think so—and that all the oil which has been used in the work must be "spirited out" of the work before it will assume a polish. The less oil you use the easier and better will be your final result. Enough oil will be held on the cork of a small bottle for use at any one time. Poppy oil is held by some to be a better lubricant for French-polishing than linseed oil, but I have always been able to get excellent results with the latter.

77. Smoothing the Polish.—The polish which has been applied in the prescribed manner will now be full of ridges and circular lines which the rubber has left in its path. These must now be removed. First allow the body of polish to harden thoroly. It is much better if this can be left a day or more before the next operation is commenced. Any undue haste in the matter will end disastrously. First be sure that your rubber is in good condition, with a smooth surface and firm shape. If the rubber you have been using has become frayed or otherwise injured use a new one. Or if the old one has been allowed to become hard it may be softened with alcohol or discarded. This time use a thinner shellac, for the purpose is not now to build up a polish but to smooth down that which has already been applied. If prepared shellac is used, thin this to the consistency of milk, with about an equal part of grain or denatured alcohol, and stir the compound well. Remove the cone from the rubber and apply only a little polish to it, not nearly so much as

before, and wrap it up. A little oil should be applied to the sole of it and the rubbing begun lightly with a circular motion *in the opposite direction to that which was used before.* This will help to smooth down the ridges left by the former process. On no account rub the work in straight forward and backward movements. This will invariably pick up the polish at the ends of the strokes. Look at the sole of the rubber often to see whether or not it is shiny. If it is, you are using too much oil. Change the cone to another place in the muslin wrapping, decrease the amount of oil used, and rub as before. Do not allow the rubber to become very dry in this part of the process, and do not attempt to smooth a soft part of the surface by pressing harder on the rubber. This part of the polishing will take quite a long time, and each rubbing must be followed by a drying interval. Never continue to work on a "tacky" or sticky surface. It is only a waste of time. When the surface of your work is quite smooth, set it aside to dry for a day or even longer. It will then be ready for the final or "spiriting out" process.

78. Spiriting Out.—The same rubber which was used for the last process may again be used if it is smooth and soft, but the novice will generally do well to make a new one. The purpose now is to remove all the oil from the polish and to make a beautiful burnished surface, free from all rubber marks and flaws. No polish is generally used in this procedure, but the cone of the rubber is just perceptibly moistened with pure alcohol. I must repeat the injunction concerning the amount of alcohol to be used. This part of

the polishing is longest and most tedious, and the natural thing for the student to do is to use too much alcohol on the rubber. A good way to gage the amount to be used is to place the palm of the hand over the bottle of alcohol and shake it once so that the alcohol moistens the palm. Then dab the sole of the rubber upon the moistened palm and rub the polish, as before, *with a rotary motion. Do not use any oil in this process.* Rub with a firm, brisk movement, but never continue the friction after the surface feels sticky. If you are in doubt about the amount of alcohol to be used, remember that it is better to vary on the side of more caution. Better too dry a rubber than one which is too moist. Take time in polishing, allowing the work to dry frequently. The beauty of the polish is now at stake; you may make it or mar it.

79. **The German Acid Finish.**—After the polish has been bodied up and smoothed, another manner of spiriting out may be used. Instead of spirits, acid is used, and for this reason the process is termed the "acid finish." German workmen, I believe, perfected this treatment. The process is accomplished as follows: Make a solution of one ounce of sulphuric acid and ten ounces of water. Sprinkle the surface to be polished with fine chalk which has been sifted thru a very fine sieve. Barely moisten the surface of a piece of fine chamois skin with the sulphuric solution, and polish as in French-polishing, with a rotary movement. The chalk absorbs the oil as it is drawn out of the polish, and a beautiful brilliancy ensues. The same amount of care will have to be taken in this process as in spiriting out.

80. The Egg-Shell Gloss.—If one does not wish the high polish that has been attained by the previous methods, he may dull it by rubbing the surface with a piece of felt, such as was described in Sec. 54, which has been dipped in raw oil and its rubbing surface sprinkled with very fine pumice stone. A coarse piece of felt will scratch the polish. Rub first with a circular motion and finish with straight forward and backward strokes. If a finer gloss is desired rotten stone may be used instead of pumice stone, but the process will be lengthened considerably. Rather more pressure will be needed in rubbing shellac than in rubbing varnish, as the former is a much harder polish.

81. Matching with Polish.—Very often unsightly variations in the color of wood will be noticed after the first coats of polish are given to the work. This need not alarm the beginner. Different shades of browns and reds may be obtained by mixing burnt umber (a dark brown powder), or burnt sienna (a powder varying from reddish brown to light red color), alkanet root (a dark red color), and drop black, with a thin shellac. A little experimenting with these colors will soon give a student a good idea of the results he may obtain with their use. When the desired shade has been obtained dip a small soft brush (a camel's hair brush is recommended for this work) into the colored polish and carefully match the color and grain of the wood. This operation should take place just before the smoothing process is begun. It is better to match the grain by applying several coats of lighter colored polish than it is to try to accomplish the result with one heavy coat. The heavy application is apt

to be rubbed off or smeared over the surface by the action of the polishing rubber. Allow each coat to dry thoroly before putting on another. Then polish as before suggested with the uncolored polish.

82. Keeping Polishing Rubbers.—If polishing rubbers are to be kept, they should not be allowed to dry out, but should be placed in an air-tight tin or bottle in which has been poured a few drops of alcohol. Old rubbers are better than new if they are kept in good condition, but once they have been allowed to become hard it will not be worth the time to restore them.

83. Care of Brushes.—Brushes which have been used in shellac may not be left in water or turpentine, as is sometimes done, but should be cleaned out with wood alcohol thoroly each time that they are used, or better still, suspended in the manner suggested for varnish brushes (Sec. 50) in alcohol or very weak shellac. Shellac, if it is permitted to harden in the brush, is difficult to remove, and will usually impair the value of the bristles. The care of brushes should be given far more attention than is usually done in manual training shops.

CHAPTER VIII

Enameling

84. Proper Use of Enamel.—Enamel as a finish has of recent years become so popular that no treatise on wood finishing would be complete without including it. Enameling really belongs to the subject of varnishing as it is a varnish, but it differs from ordinary varnishing in that the material used is opaque. Enamel has the brittleness of a piano varnish and the brilliancy that is given by a hard resinous gum. Very beautiful effects may be obtained with different colored enamels, especially when they are used as stencil colors, light upon dark, or dark upon light. As enamel is opaque, it is folly to use it over expensive woods. Maple, birch, pine, and poplar are well adapted to this treatment, and the more expensive woods may be correspondingly saved by using these frequently. The student may be led to believe that enameling is a cheap class of work and unworthy of his time and efforts. That may or may not be true. Enamel of course does not compare with oil or French polish in the matter of expense, but all the luster and softness of a high-grade varnish may be obtained by using it carefully.

85. Applying Enamel.—The student should not confuse this process of enameling with a different one which is used extensively in Europe, that of "spirit-enameling." The enamels which I am speaking of are prepared in oil like a varnish, the spirit enamels are prepared in alcohol, and are adapted especially to a

final French-polishing. For the present the varnish enamels will claim our attention, as these are more common.

Prepare the surface of the wood very carefully, sandpapering first with No. 1 sandpaper and finishing off with No. 0, rubbing always (except on the

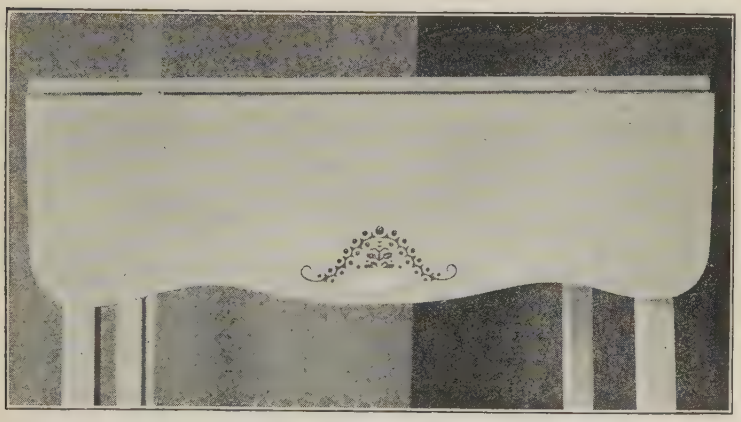

Fig. 16. Enameled table.

ends) in the direction of the grain of the wood. When this has been done and all holes in the wood carefully filled with sealing wax, give the wood one or two coats of white shellac. Orange shellac will do if the enameling is to be done in dark colors. Allow the first coat of shellac an hour to dry and rub it down smooth with No. 00 sandpaper, *rubbing with the grain.* The shellac used should be quite thin, only about half as thick as the shellac bought in prepared or liquid form. To thin shellac add one part of denatured alcohol to three parts of shellac. Do not attempt to use the thick, heavy

shellac as it will not flow like varnish, but will become sticky under the brush and harden in heavy ridges which will require a great deal of rubbing with sandpaper to obliterate. If a great deal of the first coat of shellac has sunk into the wood, so that the surface appears dry, apply a second coat, rubbing this down as you did the first. When you have finished rubbing the shellac (and be sure that it is perfectly dry before it is rubbed), apply a coat of *enamel priming white* or other good undercoating *for enamel.* Here again I may make a few suggestions which will save a great deal of time and work. If you have a large surface, such as a table top, to enamel, use a good two and one-half inch bevelled-tip varnish brush, one which has the bristles set in rubber. Be sure that this is *perfectly clean.* If a new brush is used, soak it in water over night to "set" the bristles, and then *dry it thoroly* before using it. Never use a brush which sheds its bristles. If, on the other hand, small pieces of work are to be enameled, use a smaller brush.

Allow this under coat at least a day to dry, and then rub it down to a smooth surface with No. 00 sandpaper. Dust off the surface well, and apply a coat of enamel of the shade desired for the final finish. The same caution should be maintained in applying this coat as the former. If the enamel is thick, thin it with good turpentine to the consistency of varnish. Avoid as before all over-lapping and brush marks on the surface. If the enamel does not dry in two days to a perfectly hard surface, add a little turpentine to the next coat. This will assist it. But do not thin the enamel

to a watery consistency with the turpentine or the luster of the enamel will be impaired. When this coat is dry, procure a piece of felt such as was described for rubbing down varnish, Sec. 54, moisten the rubbing surface of it with water, sprinkle over this a small quantity of fine pumice stone, and rub the enamel with a circular motion, adding water and pumice occasionally so as to keep always a well moistened surface on the felt. Rub until a smooth surface is obtained, then dry the enamel well before applying the third coat. It is usually well to allow a surface that has been rubbed a few hours to dry before applying more varnish or enamel.

The third coat is also of the color desired, and is applied in the same manner as the second. It must also be left to harden completely. Remember that enamel or varnish often appears quite hard to the touch, but that under the surface the oil is still soft. If you rub enamel in this condition you will merely grind the pumice stone into the soft gum and no amount of subsequent rubbing will produce a polish. The method of producing a high gloss is like that given to the former coat. If the wood is particularly open-grained or porous so that the enamel seems apt to sink into it, use two coats of the *enamel priming white* instead of the one suggested at first. Poplar or pine especially may require this, even after two coats of shellac have been applied. In either case the method is the same, each coat being allowed to dry well, and then rubbed down with fine sandpaper. The final coat is always, except in the cheapest work, rubbed to a gloss with pumice stone or rotten stone and water.

Fig. 16 shows an enameled table where a stencil has been used.

86. **A Word of Warning.**—If the piece that is to be enameled has been at one time painted, varnished, or enameled, all the former finish *must be carefully removed* before the new finish is applied. If this is not done, the enamel will scale and chip off or show in patches and ridges the unevenness of the old finish. The easiest way to remove old finish of any kind is with a commercial *varnish remover* which may be bought at any paint shop or hardware store. It is applied to the surface to be removed and allowed a few minutes to soften the old finish. This may then be removed with a stiff brush, scraper, or heavy cloth. It may often require several coats of the varnish remover to soften all the old matter, but it must all be removed before any finishing is attempted. If there is quite a lot of varnish to be removed, one may not wish to go to the expense of buying a large amount of commercial remover. A mixture of one part of *banana liquid* and two parts of *wood alcohol* makes a good remover which possesses the additional quality of safety so necessary for amateur use. It is well to remember in removing varnish that the several layers of old gum should be softened completely before any of them are removed. The reason for saying this is, that almost any varnish remover is quite expensive when it is used in quantities. The fewer coats of it that are used the less will be the expense of the operation. If, then, after one coat of remover has been applied to the surface, the varnish does not become quite soft, it is well to apply another coat before attempting to remove any of the

old gum at all. This will soften the old coats right down to the wood, and the whole mass may be removed with a saving of time and of material. Wood alcohol and banana liquid are very volatile, and therefore should be kept in well-corked bottles. Turpentine or alcohol alone will usually soften varnish so that it may be removed.

CHAPTER IX

Stenciling

87. Application of Stenciling.—So many beautiful effects may be obtained upon common woods finished with good interior paint or enamel in stencilled designs that a chapter on this art seems appropriate. Furniture has for a long time been painted, even at the direction of masters of cabinet work and design. And, strange tho it may seem to the student who thinks of furniture in terms of wood values alone, this painting was very often done over choice mahogany. This would seem a great extravagance to us, yet the wood used and the finish applied were two separate things to the minds of these men. Mahogany was used not so much because of its exquisite beauty as because of its strength and rigidity. Paint was applied to the wood to obtain a mellow and even color. Today there is an increasing demand for breakfast-room furniture, sun-parlor furniture, porch furniture, and wooden novelties of bright and airy color, and we have in this country woods which seem particularly well adapted to this treatment. See Fig. 16. Even bedroom furniture of this kind is coming into demand.

A little study in color harmony will repay the student if a great variety of colors is to be used. For ordinary work in two or three colors, however, a sense of appropriateness will be sufficient. For this work a knowledge of stencils will be necessary.

88. Stencils.—Stencils may be bought or made. The process of making simple stencils is so easy that every

student should make a few of his own design to enable him to see the possibilities of them in decorative work. A suitable design is traced on a piece of heavy brown paper with a carbon paper. The part to be colored, that is the decorative part or design, is cut out of the paper with scissors or the sharp point of a knife. The edges of the design will be much more smoothly cut if the paper is placed upon a piece of glass while the cut-

A B C

FIG. 17. Stencils

ting is being done. Wood under the paper allows the knife to force its way too far, and tears the edges of the design. The factor to remember in cutting a stencil is that the parts of the design are not completely joined together. Small points or connecting pieces of paper are left to give the work rigidity. See Fig. 17. If, for example, a conventionalized design of a tree or flower is being made, the limbs or branches will not quite meet the trunk or central stalk. So also the petals of a flower will not quite meet the central axis, nor the leaves and branches. These minute parts which are left in the design are called ties. The illustrative designs offered, Fig. 17, will make the meaning

clear. It is safe to say that realistic designs are seldom used in stencils. Geometrical figures, conventionalized forms of natural objects are commonly used. If the stencil to be made is one, such as a tree, which has a central trunk with a similar distribution of branches on either side, the easiest method of cutting it is to fold the paper and cut the design thru the two plies which when opened will appear as a duplicated design of branches radiating from the central trunk or fold in the paper.

89. **Treating the Stencil.**—After the stencil is complete, it should be pressed out smooth and dipped in hot paraffin to stiffen it and to keep the oil in the paint from softening it. This is essential to good work. Lay the stencil on a flat surface until it is dry.

90. **Coloring the Design.**—After the stencil is dry it may be fastened in the position it is to occupy with any easily soluble paste. The color or colors, which should be rich and of the consistency of varnish, are then rubbed on or painted with a regular stencil brush or a *clean shaving brush* which has been cut off so that only an inch of the bristles remains. This will work into the corners of the design well. Enamels of different colors, good interior paint, or colored French-polish may be used. Enamel over enamel, and paint over paint, depending upon which has been used for the finish of the piece, are best. Do not remove the paper until the decorated part is dry. Then, if the color is not sufficiently opaque, a second coat may be applied. The stencil is, of course, applied only after all finishing and rubbing has been done to the main part of the work. When the design is *completely dry* remove the

stencil and give the whole work a coat of good transparent varnish. This is necessary to hold the color. The varnish should then be rubbed down, as has been suggested, with pumice stone and water, care being taken not to rub hard over the design for fear of cutting thru the coating of varnish.

91. Other Uses of Stencils.—The decorative possibilities of stencils are almost unlimited. For instance different effects may be obtained by blocking out different portions of work that are being stained preparatory to varnishing or French-polishing. The major part of the work may be stained a dark brown, while the design may be barely tinted with a very light brown stain. In this case, however, the figure *to be left* is pasted on the work and the remainder of the wood stained a dark color and left to dry. When the paper is removed the part that has been preserved is treated to a very mild stain, and the whole given a coat of orange shellac to hold the color. Consider, too, the possibilities of decorative fuming. Any design that is cut out of paper, waxed, and fastened to the oak will be preserved in the natural color of the wood. The wax keeps the fumes from entering the paper. The design may then be given a little toning with a weak stain in some shade of brown so that it may harmonize well with the rest of the wood, or it may be left in the natural color. Such wood will not, of course, be filled with anything except shellac. Or in the case of oak will not require filling other than one or two coats of shellac preliminary to wax-polishing.

92. Transfers.—Altho the subject of transfers does not come properly under the heading of stencils, its

use is so similar that I may include it at this time. Transfers are used in somewhat the same manner as those we used to put on our school books. First moisten the surface which is to be decorated, with water. Then give the face of the transfer a thin (a very thin) coat of *transfer cement,* using for this purpose a camel hair brush. Wait a few moments until the cement is tacky, or until it has dried enough so that the fingers may be

Fig. 18. Realistic wood transfer.

run over it without removing any of the cement. Lay the transfer with the cement side down, and smooth it out lightly and quickly. This part of the process is of most importance. Now wet the back of the transfer and roll it with a small roller for a few moments. Remove the paper carefully, beginning with one corner, and press the design on well with a wet sponge. Dry it gently with a dry chamois and clean away the cement or varnish stains around the design carefully with a soft cloth moistened with water. Fig. 16 shows a stencil applied. Figs. 18 and 19 show a realistic and a conventional type of transfer respectively.

The transfer is, of course, affixed after all the staining and polishing or varnishing are finished except the final coat. Do not attempt to use French-polish directly over the transfer lest the design be loosened. Apply

Fig. 19. Conventional transfer.

first a thin coat of shellac with a brush. Then the polishing may be finished in the usual manner.

Excellent transfers may be bought from The Palm Brothers Decalcomania Company, Cincinnati, Ohio. Beautiful designs for wood calendars, trays, book ends, and pipe racks may be applied in this manner if the student does not wish to take the time to inlay his design.

CHAPTER X

Refinishing Old Furniture

93. Reclaiming Old Furniture.—The problem of refinishing furniture, and indeed of all interior woodwork is one which comes up constantly. There is a great deal of good furniture which needs only a little repair in construction and a new finish to make it quite presentable. Occasionally a valuable piece is found in almost hopeless condition, and very often this piece has some historical value that endears it to the minds of those who know. The high-school student should be able to repair this and to refinish it, unless it is too far gone.

94. Painted Furniture or Interior Woodwork.—The first thing to do with wood of this kind is *to remove all the old paint.* The easiest method of doing this is to hold a gasoline blow torch so that the flame will blister the paint. Be careful not to burn the wood. The operation is not, however, a delicate one, and almost any one may try it with success. A steel scraper with one corner rounded so that it will fit into concave surfaces is necessary to remove the blistered paint. The work should then be washed down with warm water and strong lye soap, and allowed to dry. If the surface of the wood rises because of the action of the water, it may be rubbed down with No. 0 or No. 1 sandpaper. The wood must be perfectly dry before an attempt is made to apply paint or varnish. The temperature of the room should be neither too low nor too high for

varnishing or painting; between 70 and 85 degrees is suitable.

95. If the Surface Is To Be Repainted.—Very often yellow pine or fir has been used for interior woodwork. These are very resinous woods, especially the knots of them. If paint is applied directly to such a surface it will frequently turn brown and blister off because of the exudation of the resin in the wood. To avoid this it is always safe to cover all resinous parts of the wood with a coat of shellac. In new wood this is absolutely necessary, and in old wood it is much safer. After the shellac has dried (this will take at least an hour) apply a priming coat of paint which contains a good percentage of white lead or, even better, of lithopone.

Perhaps I had better repeat at this time the statement I have made. In a volume of this size I cannot hope to deal with all the varieties of paints, oils, pigments, driers which are used and recommended. We are concerned here chiefly with indoor finishes and with the best ingredients with which to make them. If the student masters these he will have little difficulty in changing his ingredients or the proportions of them to suit special needs.

96. Composition of Paints.—Paints are composed principally of linseed oil; white lead, or zinc white, or lithopone as the base; colors, such as the umbers, siennas, ochres, chromes, lamp black or drop black, and Vandyke brown; and driers, such as litharge, turpentine, and zinc sulphate, the best of which to use with linseed oil is, in general, turpentine. These, you see, are oil, base, color (unnecessary to white paint), and

driers. Commercial paints often contain too much drier.

97. The First or Priming Coat.—With this in mind let us return to the *priming coat* mentioned above. If you wish to make this, put from eight to ten pounds of white lead (or lithopone) into a can; to this add, a little at a time, ½ gallon of pure raw linseed oil, stirring the ingredients continually until they are well mixed; now thin this with about ½ gallon of pure turpentine. No color is, of course, needed in this undercoat. Just before you use the paint, add to it two or three tablespoonfuls of best quality *turpentine driers*. Sandpaper between coats.

98. The Second Coat.—The second coat should contain little or no oil if white or very light colors are used. The oil tends to turn yellow unless it is exposed to the direct rays of the sun. Mix the lead with turpentine only. This will make a *flat* or dulled finish. Oil makes gloss. If the paint is to be colored dark, the second coat should contain much more oil and much less turpentine than the priming coat. A pint of turpentine and ½ to ¾ of a gallon of oil will be about the right proportions for mixing eight pounds of lead. The color should be added to the oil and lead before the turpentine.

99. Third Coat.—The third coat will be merely white lead or lithopone, turpentine, and driers as in the second coat, if a pure *white flat finish* is desired. If, however, a *gloss white* is desired you will do well to make this coat by mixing 4 pounds of zinc white in a gallon of damar varnish. In place of this a third coat of the flat white paint may be applied and a final coat

of transparent varnish over this. This may, of course, be done with colored paint also.

Colored enamel varnishes which will make a satisfactory finishing coat are obtainable on the market. These are applied in the same manner as clear varnish. When they are to be used the undercoat should be colored approximately to match the color of the varnish.

100. Rubbing Down Final Coat.—A finer finish will be made if the last two coats of paint, or the last coat of paint and the varnish coat, are rubbed down with pumice stone and water. If rubbing is to be done the paint and varnish must be allowed to dry thoroly before it is attempted. I cannot insist upon this too often. It is one of the commonest mistakes of amateurs and professionals. A final rub with a cloth dampened in oil will remove the pumice stone from the surface and leave it a beautiful gloss. I may add, in conclusion, that the best interior painting consists of four coats, the last of which may be varnish. It is always well to strain all paint thru a doubled piece of cheese cloth before using it.

101. If the Old Surface Is To Be Varnished.—Remove the old paint in the manner suggested above. In this case, however, more care will have to be exercised in ridding the wood of all discoloration which the old oil has caused. In places where the stain or oil seems to stick fast use some commercial varnish and paint remover, or an application of wood alcohol will often serve, to soften the paint. If there are holes, they must be filled with a paste of fine sawdust and glue; a slight indentation may be removed with the scraper, but this abraded part must be smoothed

before any stain is applied. Grease or ink spots or discoloration of any kind may be removed by an application of a weak oxalic acid solution. When the wood is thus freed from all the old paint, it may be washed off with strong soap and hot water. This should be done before the holes are filled, if a glue paste is used. When the surface is thoroly dry, the stain may be applied. Altho all the surface coating has been removed, the pores of the wood are still, to a certain extent, filled with the old filler. Because of this a water stain is not often advisable. I suggest that a spirit stain be used in this case. It is best applied on such a surface, not with a brush, but with a small wad of cotton cloth. Upon resinous woods such as firs and pines a spirit stain will penetrate where a water stain will not. Match the color as evenly as possible and allow the work to dry. A coat of thin shellac may then be applied to "fasten" the color, or, in case a considerable amount of work is to be done, a coat of *liquid filler* may be substituted. The shellac is better, however, for general purposes. This must be rubbed down with fine sandpaper, dusted off with a clean cloth, and the finishing done in one of the ways which have been minutely described under the different ways of wood-finishing. It is very difficult to finish in natural color woods which have been formerly painted. Light-colored woods should be stained; the dark woods may be successfully finished without staining if it is desired.

102. Refinishing Old Varnished Woodwork.—There is no permanent remedy for "checked" varnish and cracked paint except to remove the old finish and to apply a new one. Old varnish may be removed most

easily with a commercial varnish remover. The surface must then be well rubbed down with fine sandpaper, dusted and restained. When the stain is dry the wood should be re-filled with either a paste filler if it is open grained, or with a liquid filler if it is close grained. These two classes of fillers have already been explained in Chapter III of this book, and so I shall not repeat the description. The wood may then be finished in any of the ways that have been described. A spirit stain rather than a water stain is recommended for restaining. After the wood has been cleaned as described refinishing may be done in about the same manner as finishing on new wood.

103. Automobile Refinishing. — The problem of refinishing automobiles is one which scarcely comes within the scope of this work, yet I have ventured to include it because of its practicability. Before the day of the air brush all vehicles were finished by the use of a hair brush. As many as eighteen coats were applied to a piece of work. Each coat was rubbed down carefully before the next was put on. This was, of course, a slow process. Today seven or eight coats, indeed often fewer, are sufficient.

I feel sure that few, if any, of the readers will wish to take the time and go to the expense of applying more than four or five coats to a car. With a little care, however, one should be able to make the "old boat" take on quite a presentable appearance.

The first thing to do is to wash all mud and dirt off the car. Then all the old enamel must be removed. This must not be done in a slipshod manner. A good and cheap compound which will remove paint, varnish,

or enamel from metal may be made by mixing together five pounds of ordinary flour, three pounds of lye, and enough water to make a thin paste. Apply this to the coating to be removed and allow it to stand for five minutes or longer. The old coat may then be removed easily with a dull tool. The chief difficulty may be had in taking the enamel off the hood, but the same remover will do it if you leave it on the surface for an hour. Even the hardest baked enamel finish will yield to this remover. Care must be taken not to get the remover on the hands or clothes. The car should then be washed off well with benzine or *high-test* gasoline. Ordinary gasoline will leave the surface greasy.

The night before the refinishing is to be done, wet the walls, floor, and ceiling of the garage. This must be done to settle the dust. Remember that half the success of finishing depends upon suitable conditions. The car must be perfectly dry before any enamelling is done. It is necessary to have a free circulation of air where varnish or enamel is drying, but there must not be a draft to blow dust upon the wet coat. If the windows of the garage are left open, tack a piece of wet muslin over them. This will permit the air to enter, but it will exclude the dust which would mar the finish.

It is well to have at least two brushes, and these should be of good quality. One of these may be three inches wide, the other about three-quarters of an inch. The wide brush will be used for large flat surfaces, the narrow one for spokes, rims, and other fine work. I must repeat the injunction which I have made in this book: *do not use new brushes without cleaning them.*

New brushes are not clean. They must always be washed in turpentine and allowed to dry before they are used. Dust and loose hairs may be removed, to some extent, by rolling the handle of the brush vigorously between the palms of the hands.

When everything is ready a coat of "flat undercoating," such as is made for this purpose, may be applied. This should be allowed at least forty-eight hours to dry, after which a second coat of the same may be given to the work. When this coat is thoroly dry, not before two days, it should be rubbed lightly with No. 0 sandpaper. This will cut off the tops of any dust particles which have entered the coat. The car should again be wiped off with a clean cloth moistened with benzine.

At least two coats of automobile enamel should be applied. These must not be thick and heavy. The enamel should flow freely from under the brush. In applying either varnish or enamel, the less brushing that is done the better. This is what the painter means by "flowing on a coat." Any excess which may run to the bottom or corners of the work may be picked up on the brush. A cold, damp garage is no place in which to do enamelling. The atmosphere should be moderately dry and of a temperature between seventy and eighty degrees Fahrenheit. Enamel will flow much better if the can is placed in a dish of warm water while it is being used, care being taken not to overheat it. The first coat may be sufficiently dry to rub down within two days, but it is well not to attempt to hasten it. Enamel and varnish may feel hard to the touch and yet be quite soft underneath. For this reason, unless

there is urgent need for the car, a few days longer give a better rubbing surface.

The first coat of enamel may be rubbed down with No. 00 sandpaper (never with steel wool), and the surface wiped off as before with a cloth dampened with benzine. The second coat should be applied in the same manner. This coat should, however, be rubbed down with pumice stone. To do this procure a piece of harness-maker's felt about four or five inches square, wet it thoroly with water, and rub first with a circular motion and finally backward and forward the surface which has to be sprinkled lightly with pumice. Use a fine grade of pumice and be careful lest you rub thru the enamel coating. Pumice stone cuts quite rapidly, and more harm than good will result from a careless use of it. When the surface is well polished wipe off the work, this time very carefully, and remove any pumice which may remain in corners.

The last process is to "flow on" a coat of good weatherproof varnish. Brushes should be well cleaned before this is done, and the utmost care should be exercised in ridding the garage of dust by wetting the floor, walls, and ceiling again. This last coat is not rubbed down, and so one has no opportunity to remove specks of dust which have entered it.

CHAPTER XI

Woods and Their Treatment

104. Apple.—This wood is especially adapted to ebonizing. It has but little place in cabinet work on account of its greater value as a fruit tree and its scarcity as a commercial wood. It is very close grained and susceptible to fine polishing.

105. Basswood.—A considerable quantity of this wood is used in cheaper cabinet work. It is close grained, very soft, quite free from knots, and takes stain well. It is frequently used to imitate mahogany, but other woods are perhaps better adapted to this purpose.

106. Beech.—Imitation walnut and mahogany are sometimes made from this wood, but it does not seem adapted to this purpose because of its prominent figure. These are, as in oak, the medullary rays of the wood. They are finer than those of oak, but very hard and impervious to stain. It is perhaps best left unstained, and finished in the natural wood.

107. Birch.—Birch has had for some time an increasing demand in the furniture industry. There are three kinds of it common to North America: white birch, yellow birch, and red birch. These are all valuable woods, but of the three the one most common to furniture is the last. This timber has a beautiful reddish brown color, in some respects similar to that of cherry, altho usually not so dark. The wood, too, is not so close grained as that of cherry.

The best imitation of mahogany may be made from birch.

To stain birch a rich plum color apply a solution composed of four tablespoonfuls of potassium bichromate dissolved in a quart of water. Allow this to dry, and rub the wood down with fine sandpaper. The fibers of birch rise very readily under water stains. Then make a solution of equal parts of Vandyke brown and burnt sienna dissolved in such quantity of hot water as to make the desired shade. Apply this hot to the wood and allow it to dry. You will notice that the grain of the wood has risen considerably again. This time do not use a special wood filler but apply a coat of thin shellac, either orange or white. I may add that any filler except shellac is injurious to good clear effects upon maple, pine, poplar, gum, and birch. When the shellac has dried upon the birch the wood fibers, which have risen a second time because of the water stain, may be rubbed down to a good smooth surface. The work may then be finished with French-polish or varnish.

To stain birch brown mahogany, apply to the wood a solution of brown bichromate of potash such as was suggested above. When this is dry, rub down the roughness and apply a brown oak water stain which has been weakened a little more than is customary by adding more water. This stain should have little if any reddish tone. If the brown oak stain is used in full strength it will make the birch too dark. In this case it is better to make the desired color by several weak coats of stain than with one strong coat. Successive applications of bichromate of potash solution

alone will have a darkening effect upon the wood which appears as different shades of brown under polish, depending upon the strength of the solution. If orange shellac is used in finishing, either as varnish or as French-polish, the effect of the work will be better. Over the stain should be applied at least one coat of shellac. Use no filler or oil.

To finish birch in the natural color, use no oil, filler, or varnish. The best, and indeed the only correct way to do this is with pure bleached shellac. By some, a Damar varnish is used over bleached shellac, but this is not satisfactory because of the softness of this kind of varnish.

If birch and mahogany are used together in woodwork the easiest way to match the two is to apply one coat of stain to the birch alone. Use no filler on the birch but fill the mahogany if you wish. When the stain is dry, rub down the surface roughness and apply to the whole work, mahogany and birch, another coat of stain. This will match the color well. Finish the work in any manner after applying and rubbing down a coat of shellac. This manner of matching woods which are at all akin to each other may be followed with satisfactory results.

108. Cedar.—Of the many kinds of cedars used in woodworking only a few are of interest to the cabinetmaker. The mahoganies and the cedars are so closely related that it often requires an expert to determine which is true mahogany and which is not. Indeed a great deal of the wood which is sold under the name of mahogany is cedar from Central and South America. The wood of this cedar is a brownish red or reddish

brown color, with alternate light and dark stripes like mahogany, but it is lighter in weight and softer in composition than mahogany. This cedar is not, however, to be despised as an imitation. It is often a good wood for furniture making, and can be made, by the art of the French-polisher, to resemble mahogany more nearly than any other wood. It lacks, however, the strength and firmness of the other wood.

Red cedar has for some time been prized as a beautiful wood. Its use is now almost entirely confined to the making of chests and the lining of drawers in expensive furniture. It has a pleasant odor and a beautiful light red color, and is considered immune from the invasion of moths and other insects. It is close grained and soft in texture, and takes a high polish. *On no account should filler, stain, or varnish be applied directly to the wood.* Knots, which are quite common to it, should be well smoothed with a sharp steel scraper, and any cracks in them filled with a correctly colored wax-stopping such as has been suggested in Chapter I. A glue and sawdust paste, colored suitably, will also be satisfactory. The work should be carefully sandpapered and dusted off, and then given successive coats of pure bleached shellac, either with a brush or in the manner of French-polishing. Oil, if it is applied to the wood, will turn it an objectionable reddish brown color. Varnish injures the beauty of the wood in two ways if it is applied without a surfacer: the oil in the varnish darkens the wood in an unpleasing manner; and the color of the varnish, which is not really a colorless fluid at all but of a slightly amber color, detracts from the natural

color of the wood. If you must use varnish use it over two coats of pure bleached shellac which serves both as a surfacer and as a filler. This will prevent the discoloration of the wood which oil always effects. I may say as a rule for manual training shops, *use nothing but white shellac on red cedar,* and if this can be applied as French-polish the work will take on a beauty which was not thought of before.

109. Cherry.—This is a hard, close-grained wood of rather more uneven texture than hard maple or birch. The grain is not usually straight but rather naturally wavy. This figure is, of course, to be preserved in finishing. Cherry is usually finished to imitate mahogany, but I see no reason why it should not be used as a wood with its own characteristics preserved. Cherry is frequently finished in a bright scarlet color, but this does not seem to me to be adapted to the beauty of the wood or to its inherent qualities. It is a reddish brown in color, quite like Spanish cedar, and the natural tone of the wood gives but little reason for the violence with which finishers treat it when they color it in vivid scarlet. Just as the prevailing note in staining mahogany has recently changed from plum to deep brown, so should that of cherry be changed from blood red to an appropriate shade of brown. A good color may be obtained by coating the work with an application of bichromate of potash (one ounce to a gallon of water), allowing this to dry, and rubbing down the wood fibers with fine sandpaper; and then applying a stain composed of one ounce of Bismark brown, one-half ounce of burnt sienna, and two tablespoonfuls of vinegar. These should be dissolved in a

quart of boiling water and applied warm to the wood. The work should be given a coat of orange shellac if varnish is to be applied, or better finished entirely with orange shellac applied with a brush or with a rubber as French-polish. If the shellac is to be applied with a brush it must be quite thin, not more than half the strength of commercial prepared shellac. Always use grain or denatured alcohol to dilute shellac. Wood alcohol will cause it to dry too rapidly.

No matter how long you may sandpaper cherry you will notice in staining the wood that portions of it absorb the color more quickly than others, and become consequently darker. There is no way to avoid this as it is caused by the peculiar formation of the wood which in places exhibits almost an *end grain*. Do as much of the smoothing as possible with a sharp steel scraper. Use sandpaper sparingly, and do not apply the stain in heavy coats. If these more porous parts are thus treated they will serve to increase the beauty of the finish rather than to impair it.

110. **Chestnut.**—This open-grained wood may be treated in the manner suggested for brown oaks. Fill the wood with paste filler colored with burnt umber, and use varnish or orange shellac for polishing.

111. **Cypress.**—Because of its resinous quality this wood is quite difficult to stain. This accounts, too, for the numberless instances in which paint and varnish peel off the surface of it. A water stain should be applied very hot to cypress. An exceptionally resinous portion of the wood should be treated to at least one coat of shellac before it is painted. Very beautiful hand carving is often done in cypress, the grain of

which shows in flakes almost like sedimentary rock formations. This antique appearance must of course be finished with wax to carry out the purpose. Never attempt to finish or to darken this wood with oil. If it is to be painted, apply at least three coats of shellac to the wood before attempting to paint it, otherwise your work will be in vain.

112. Ebony.—The natural color of ebony is seldom black, but rather a very dark brown. It requires a stain to make it the color we usually think of as ebony. This may be supplied easiest for the amateur by using *black India ink*. However very little if any of the genuine wood will be used in manual training work because of its extreme scarcity. Excellent imitations may be made from pear and apple woods, and the student is advised to use these when he wishes a pure black wood for decorative purposes.

113. Fir.—The commonness of this wood in interior work leads me to give suggestions as to its treatment. Fir may be stained to almost any color. It is of heavy-grained and resinous texture with alternate hard and soft ribs of fibre. The hard parts do not take stain very readily, especially a water stain. In preference use an oil or spirit stain, or even better, a chemical stain. Cover any knots in the wood with a coat or two of shellac, before applying paint or varnish to the surface.

114. Gum.—There are three varieties of gum native to North America: red gum, tupelo, and black gum. Of these three the first is that which is used in cabinet-making. Red gum is a soft, close-grained wood which seems well adapted to panelling, but scarcely strong

enough for heavier structural work. The wood is quite free from knots and may be polished easily, altho it does not deserve the precedence it is receiving over many other woods. Gum holds glue very well, and as it is clear and straight-grained, is quite successfully used in veneers. Occasionally one finds pieces of it which have beautiful smoke-like streaks in them. Such wood is usually finished without staining, a coat of bleached shellac and two or more of varnish serving to bring out the mottled or streaked appearance better.

To finish gum in a mahogany color, apply one or more coats of mahogany water stain, rub down the fibres, and finish with varnish or shellac. It is not necessary to use a filler on this wood if shellac is applied. A colored liquid filler composed of corn starch, burnt umber, and varnish may be applied if the wood is to be finished quite dark.

115. Maple.—This is one of the best woods for cabinet work. It is strong, close-grained, free from knots and flaws, of even texture, and takes any kind of stain well. As a wood for imitating mahogany few excell it, while the width of the boards into which it may be cut, makes it well adapted to veneers and ply-wood.

There are many varieties of maple all of which are native to North America, but the one which is prized so highly in cabinet work is the rock or sugar maple. Different causes produce, as in mahogany, different formations in the grain of it, and so we have curly maple, and bird's eye maple, as well as the straight-grained or true formation.

To finish maple in the *natural wood* color, prepare the surface very carefully and apply a thin coat of

white shellac. No other filler is needed. When this has been dried rub down the surface with fine sandpaper. In this way apply two or three coats of shellac, but use pumice stone and water instead of sandpaper for rubbing. The last coat may be either white shellac or *white copal* varnish. This should be allowed to dry at least four days, and then rubbed to an egg-shell gloss with pumice stone and water. Never use varnish directly upon maple which is to be finished in the natural color of the wood.

Bird's eye maple may be finished in the same manner, altho, if the piece of work is small, it will repay you to French-polish it, using white shellac. A high gloss should not be left on woods finished in the natural color.

Curly maple may be finished in the *natural wood* or stained a dark reddish brown with propriety. It can scarcely be said that any stain adds to the beauty of curly maple. Finished with French-polish it is almost incomparable.

To match mahogany with maple follow the suggestions given under the treatment of birch, Sec. 107.

White or soft maple is esteemed for making inlays on account of its pure whiteness. In marquetry work in which colored woods are used apply only white shellac as filler and surfacer, finishing the wood with French-polish or *pale copal varnish.*

In imitating the figure of mahogany on maple many methods are used. The easiest one of these for the student is to apply a coat of light mahogany stain to all of the wood. Then paint the stripes which are to remain light-colored with thin bleached shellac. Go

over the work again using a slightly stronger stain than that which was used before. When this is dry, wipe off the shellac with a cloth moistened in alcohol and rub down the surface with fine sandpaper. The work may then be filled and polished in any desired manner.

116. Mahogany.—This beautiful wood, which is now the most valuable of commercial cabinet woods, comes from the West Indies, Central America, and West Africa. It does not grow in groves, as do oak and maple, but in single isolated trees which tower magnificently above the others of the forest. Men are sent out to find these, and of recent years aeroplanes are often used in scouting for them. A great deal of waste is still in evidence in felling these trees as the trunk is cut some feet from the ground, and the stump, which often contains the most beautiful wood, is left to rot in the ground. The so-called *Spanish mahogany* of a generation ago came from Honduras, the West Indies, Cuba, Haiti, and San Domingo. But of recent years the center of the industry has become West Africa. The African mahogany grows to a much larger size than that of the West Indies, and the exquisite figuring of some of the logs brings fancy prices. One log a few years ago was sold in London for almost $8,000.

Mahogany belongs to the cedar family of trees, and in cases is difficult to distinguish from some species of cedar. Taking advantage of this, wholesale lumber merchants sell a great deal of the cheaper wood as mahogany, altho it has not the strength and rigidity of that wood. At present the Cuban wood is more val-

uable than the San Domingo or the Honduras, because of its finer texture, but it is scarcely a difference which one can explain. Even experts sometimes have difficulty in identifying pieces of lumber, especially after they have been finished.

The figure of mahogany is not, like that of oak or walnut, due to internal and natural conditions, but because of external and abnormal conditions. Wood develops with straight grain naturally, but high winds, unusual climatic conditions which would cause sudden contraction of the fibers, excessive sunlight and heat on one part of the tree, may cause a breaking down of the usual growth. Then as each annual layer of fibre is produced it adapts itself to the previous growth, forming as time passes an unnatural but beautiful figure.

"Roe" or stripy figure is the most common characteristic of mahogany, altho it is possessed in a lesser degree by other trees, Fig. 20. This figure consists of alternate stripes of dark and light wood. The strange formation of these bands makes them appear light or dark according to the angle from which they are viewed. Thus a dark band will appear as a light band if it is viewed from the other end of the wood, and the light band will appear dark. This peculiarity of mahogany makes it a simple matter to distinguish it from stained birch, poplar, or maple. Spanish cedar, or "cigar box" mahogany has similar stripes, and cannot so readily be detected. Broken roe figure is a common variation of the roe. In this case the bands are not continued thru the wood but are broken off.

Mottle mahogany, Fig. 21, is marked by dark uneven

FIG. 20. "Roe" figure in mahogany.

rays which cut transversely across the roe. Mottle mahogany is not an uncommon figure. It may appear in conjunction with the roe bands or without them. It is not often imitated on other woods. Fiddleback mottle, Fig. 22, seems to be merely a further development of the ordinary mottle. The wood in this appears when viewed in a certain light to have a wavy surface.

Crotch mahogany, a photograph of which is shown in the frontispiece, is a growth formed in a regular way at the junction of the limb and the tree, or in the roots. It resembles in its formation curly walnut, and a similar formation in maple and other trees.

Another variety of grain, called curly mahogany, is shown in Fig. 23.

117. Staining Mahogany.—Contrary to common belief and practice, mahogany should not be heavily stained. In good cabinet work, dark stain on mahogany is used to hide a cheap piece of wood, the better portions being allowed to exhibit their real beauty. One of the easiest ways of coloring mahogany is to apply a coat of raw linseed oil to it. This will darken the wood quite a little. Try this on a piece of wood before you do other staining and see if it is the color you wish. The oil may be colored to any desired shade of red by steeping alkanet root in it. Three ounces of alkanet to a pint of oil is usually strong enough. This must be simmered over a slow fire for several hours.

A solution of potassium bichromate (one ounce of the potassium bichromate to a quart of hot water) darkens mahogany to a rich brown. If a reddish brown color is desired add a heaping teaspoonful of Bismark brown to the above compound.

FIG. 21. "Mottle" or "Roll" figured mahogany.

Mahogany may be fumed, and gives beautiful results under this treatment. An application of tannic acid, such as was suggested under Sec. 27, will be necessary, however. Do not use a filler with fumed mahogany. Apply one coat of orange shellac (or white shellac if the pores are to show white), rub down the surfacer, and polish with white or brown wax.

Sheraton mahogany. This finish will be seen to be a combination of the two suggested manners of finishing mahogany. The wood may either be fumed to a dark brown or stained with the potassium bichromate stain. If the stain is used rub down the work lightly with fine sandpaper. In either case apply (after the fuming or staining) one or two coats of raw oil and alkanet root in the proportions suggested above. Do not apply this like an ordinary stain but scrub it into the grain as if you were oil-polishing it. The work may be finished in oil-polish if it is desired.

Another manner of finishing sheraton mahogany is as follows: After the wood has been stained or fumed and oiled, allow it to dry over night, then wipe off any excess grease with a cloth dampened in alcohol. Then fill the grain with a paste composed of equal parts of Van Dyke brown and burnt umber with about half the quantity of *rose pink,* mixed with commercial paste filler in the proportion of one part of the coloring to ten of the filler. Apply a coat of orange shellac and finish the work in varnish or shellac.

Chippendale mahogany. The English method of producing this finish is as follows: Mix Van Dyke brown and burnt umber (equal parts) into a stiff paste in liquid ammonia. Thin this with water to the con-

FIG. 22. "Fiddleback" mahogany.

sistency of an ordinary water stain, and apply one coat of it to the wood. Allow this to dry, rub down the surface lightly with fine sandpaper, and apply a solution of Bismark brown water stain (about three tablespoonfuls of Bismark brown to a pint of hot water). Surface the work, when it has become dry, with orange shellac into which a small amount of Bismark brown has been dissolved (a teaspoonful of the coloring to a pint of shellac), and rub it down again to cut off any fibers which may have risen. Polish the work with French-polish using the same colored shellac which has been applied as a surfacer before. To save time in the operation the wood may be filled with a silex paste filler which has been colored with Bismark brown to match the stain. The English effect of this treatment is a plum or damson color. American finishers seem to desire a predominance of the brown color rather than that of the red. The following solution will give the desired shade usually. Make a solution of two-thirds of an ounce of potassium bichromate, one-third of an ounce of walnut stain powder (water stain), two-thirds of an ounce of *mahogany red,* and one gallon of hot water. Apply this to the wood as usual, and allow it to dry. Fill the grain with a natural paste filler, colored to a brown shade with Van Dyke brown, burnt Italian sienna, and a little rose pink. Finish in orange shellac or varnish.

Antique mahogany. Color the wood to the desired shade, if a red shade is desired, with oil and alkanet root as described under *Staining Mahogany,* Sec. 117. Apply a coat of thin shellac colored with a small amount of burnt umber, and allow it to dry. Rub the

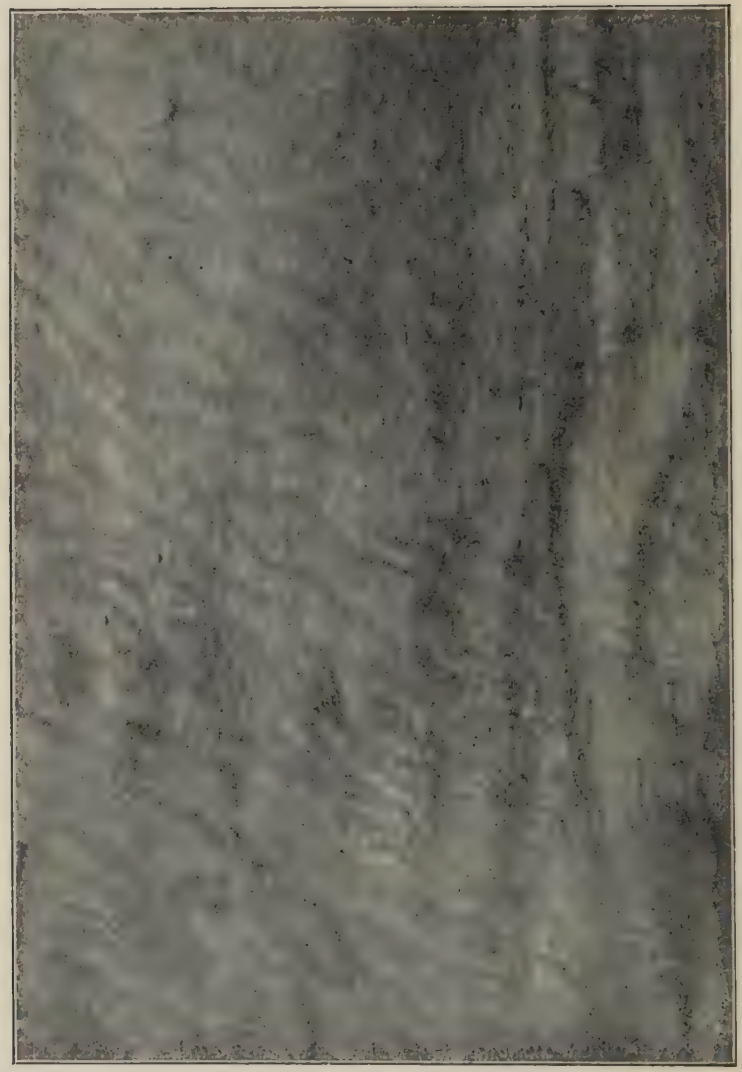

Fig. 23. "Curly" mahogany.

surface very smooth with fine sandpaper, and finish in *white wax,* to which has been added a small amount of carbonate of zinc.

A similar effect in brown instead of red is quite pleasing. Color the wood with burnt umber and burnt sienna (ground in oil), or burnt umber with Venetian red, or with the potassium bichromate and water stain already suggested. When this is dry, apply one coat of orange shellac, rub down the surface and finish in white wax to which has been added a little carbonate of zinc, and, if a grayer effect is desired, a little drop black, just enough to give a gray appearance to the wax.

Never apply a stain to your work until you have tested it carefully on pieces of wood which are similar, in color and in grain, to that which you are using. A slight difference in the color or texture of wood so alters the final result of staining that it is impossible to give formulas which will act alike in all cases. If the color of a stain does not seem to suit, remedy it by adding a little more of the desired pigment, or by lessening the amount of some other. In general students will be prone to color their work too dark, but a little experience will do wonders in helping them to correct their faults. The art of wood-finishing is not a mystery, to be obtained only by a few. It is true that matching on a large scale involves a considerable amount of knowledge. But the student will not be required to do such work, nor will he have need of knowing how to do it. One of the delights which should not be denied to the student of wood-working is the experimentation with colors and finishes to secure results which are particularly pleasing to himself.

118. Oak.—There are about fifty species of oak in North America, the most common of these being white oak, red oak, and burr oak. These vary greatly in size, in the color of the wood, in the compactness of the fibers and in many other particulars, but they all have in common as cabinet woods the prominent medullary rays which are the figure desired in quarter-sawing. None of our American oaks equal in strength and fineness of grain the English oak.

Oak is the greatest of woods, and pre-eminently the wood of romance. Its groves were the scenes of druidical rites and ceremonies; its strength and durability have made possible types of architecture; its imperviability made the "ships of the line," and these made famous the names of Drake, Frobisher, Howard, and Nelson. Oak has thus made history, and when we today, reverencing its associations, make furniture out of it we must be aware of its history in order to create designs and use polishes that are consistent with its story of worth to civilization.

It is because people have not paid attention to the appropriateness of wood finishes that they have created the color we know as golden oak. The story of the wood, of its rugged, weather-resisting power, is not told truly by this mode of finish.

Oak may be finished in more ways than any other wood, and suitably too. The history and longevity of it demand two fundamental considerations in finishing: giving an aged appearance to the wood, and a smooth dull gloss or luster to beautify that appearance. For how could a slippery surface be fitting to a wood which was withstanding storm and weather before Columbus

was born, for such is probably the piece of oak which you are now using? The following ways of finishing oak are suggested, and in these you will note that chemical stains are commonly used. The reason for this is that these stains are best adapted to giving the antique appearance so desirable to oak.

Dark brown or cathedral oak. Make a solution by dissolving two ounces of permanganate of potash in a quart of *cold water.* Apply this directly to the wood and allow it to dry. If the color is not sufficiently dark apply another coat of the same stain. Rub down the fibers of the wood which have risen because of the action of the water, and apply two coats of orange shellac. The color will be intensified if a teaspoonful of *drop black* is added to each pint of the shellac used in surfacing. Rub down each coat of shellac well with fine sandpaper, rubbing in the direction of the grain, and finish the wood with several coats of brown beeswax polish. Do not rub this to a high gloss, however. Quarter-sawed oak is not generally used with this finish.

Fumed oak with white-pored effect. Fume the oak, in the manner suggested in Chapter II, to a chocolate color. Rub the surface well with a mixture of equal parts of turpentine and raw linseed oil and allow it to remain over night. Remove any excess greasiness with a cloth moistened in alcohol, and apply one coat of thin *white shellac* to which has been added some fine silica (about two tablespoonfuls to a pint of shellac). Allow this a day to dry, and then rub the surface with fine sandpaper. Brush off the work and finish it with several coats of *white wax.* Do not rub the wax to

a high polish. This finish is used on quarter-sawed oak.

Fumed oak with dark-pored effect. Fume the oak to a chocolate color, and rub the surface with oil and turpentine, in the manner previously suggested. Wipe off the surface with a cloth moistened in alcohol, and apply two coats of orange shellac. A better effect will be obtained if a little burnt umber is added to the shellac. Finish the wood with brown beeswax or ordinary beeswax and turpentine paste to which a little burnt umber has been added. Quartered oak is usually used for this treatment.

Weathered oak. There are so many different shades of weathered oak that it would be only confusing for me to attempt to enumerate them. The color varies from a very dark brown to a deep black, and many ways are suggested for the finishing of it. The following formula will give good results: Dissolve one ounce of walnut brown, three tablespoonfuls of potassium bichromate, one-half ounce of nigrosine, in a quart of boiling water. Sponge the wood well so as to open the grain, and allow it to dry. Rub down the surface and apply a coat of stain. If the color is not very dark apply another coat of the stain when the first is almost dry. When this has dried, apply a coat of orange shellac to which has been added a little *drop black.* Cut the wood fibers down lightly with sandpaper, and finish the work with white wax.

Flemish oak. This color also seems to variate in the minds of different finishers. A deep coffee color is sometimes desired while an almost black is occasionally sought for. The deep brown color may be obtained

by first treating the wood to a solution of potassium bichromate (two ounces of the potassium bichromate to a quart of water). Allow this to dry, and sandpaper the surface lightly. Then apply a solution of one ounce of drop black, one-half pint of oil and an equal amount of turpentine. Rub this well into the pores of the wood with a cloth, and after a few minutes wipe off any excess stain with a dry cloth. Apply a coat or two of orange shellac, and wax-polish to a very dull finish. Only quartered oak is used.

Jacobean oak. The genuine Jacobean finish is of a rich brown color which shades to a light brown in spots. The light portions are not made at random on the work, but must be in imitation of usage. They are therefore made on such parts as would naturally receive the most wear in ordinary household service. The center of panels, the center of drawer fronts, the edges and high parts of mouldings, etc., may be lightened suitably. One can scarcely imitate this finish unless he has seen examples of it, but the student's imagination will be of greatest service to him in arranging the gradation of shading. The stain may be made as follows: Take equal parts of Van Dyke brown and burnt umber and mix them together in raw linseed oil into which has been put a small amount of drop black. Thin the solution with turpentine and stain the wood freely. Let this dry thoroly and then rub off the parts which are to show light with fine sandpaper. Great care must be exercised in this process to see that the dark color gradually merges into the light *without any line of demarcation.* Mistakes will of course frequently be made, but these can be easily

remedied by applying a little more stain where it is necessary with a small wad of cloth moistened in the stain. The center of the rubbed parts should be of even color. When the rubbing has been satisfactorily done, apply two coats of orange shellac, and wax-polish the work. Straight-grained oak is used for this finish, and the wood is never filled.

Driftwood oak. Allow a pound of unslaked lime to slake in two quarts of water. Rub the lime over the surface of the oak across the grain of the wood. Give the surface time to become partially dry and then wipe off the excess lime rubbing across the grain. Apply to this, when it has become thoroly dry, a coat of thin white shellac. Cut off the surface fibres with sandpaper and finish the work with white wax to which has been added a small amount of *zinc white.*

Mission oak. There are a great many shades of so-called "mission" oak. The effect of black with a light filler is common, and I shall give it here as typical of the finishes altho there is a great variance. One-half of a pound of drop black, two tablespoonfuls of raw sienna, and a small amount of japan drier, are dissolved in turpentine and strained thru coarse cloth. Perhaps it is well to say that these colors should be ground in oil. This stain is applied to the wood and allowed to dry. The work is then given a coat of thin, white shellac and rubbed down. A light-colored filler is generally used. This may be supplied by adding a little zinc white to a white wax paste, rubbing the wax across the grain until the pores are filled. Then polish in a dull gloss.

Gray oak. This color may be obtained by coating the

work with a mild solution of silver nitrate (about a five per cent solution). Cover the work at least twice with this, then apply a solution of commercial hydrochloric acid. The wood will change to almost a plum color under the acids. When this is dry neutralize the acid with a coat of ammonia of ordinary strength. Do not touch the work with the fingers while it is wet, or the marks will show. Use the ammonia out of doors as its fumes are injurious and stifling. Let the work dry *in a dark place,* after the nitrate and hydrochloric acid have been applied. Finish with white wax.

119. Pine.—Of the great number of these resinous trees, only a few are really adapted to the needs of furniture making and interior woodwork, altho many of the species are useful in outside work. All pines are more or less resinous, and even this differs considerably in the individual trees. In using a water stain, then, care must be exercised that the color "bites" in to the portions which are especially high in gum. The use of vinegar as a mordant is to be recommended here. If knots are encountered they must be heavily coated with shellac so that the subsequent exudation from the wood may not loosen the finishing coats of varnish or shellas which have been applied. The resin in the knots will quickly discolor any light-colored paint if it is applied directly to their surface. For this reason too, shellac must be used. Good yellow or white pine may be used, in general, very well in constructive work which does not require toughness or strength greatly. It may be stained any color, but it is an excellent base for enamel and paint. Use always

a liquid filler with this wood. White shellac is best for this purpose.

120. Georgia Pine.—This wood has of recent years come into considerable demand in interior work. Altho many suggestions are offered as to the finishing of it, there is only one which will eventually prove successful. Oil should not be applied to pine, either in the form of stain or in the varnish as is the case when the latter is applied directly to the wood or without a surfacer. It *muddies* the color of the wood eventually, even tho it shows well for a time. The best treatment of Georgia pine is simply successive coats of white shellac. If the work is so large that this seems too expensive, apply one or two coats of white shellac, and follow these with pale varnish. White or pale copal is good for this work. Do not use a Damar varnish as a final coat in any work. It is too soft. The student will have to guard against finger spots or greasiness on the wood before it is finished. Pine especially shows these more noticeably than most other woods.

Oak stains and fillers such as have already been described may be used to obtain pleasing effects of brown on this wood. If the stain does not seem to "bite" into the wood, finish it by making the necessary color by adding pigment to a shellac base. A few coats of this will produce a good effect. A water stain used with a dark brown filler will heighten the figure or harder portions of the wood admirably.

121. Poplar.—This wood is generally used in construction where paint or enamel is to be the finish. It is commonly used also to imitate mahogany and in

the texture of the grain seems particularly well adapted to this treatment. It may be stained in any way satisfactorily, but in matching the mahogany of other parts of the work it must be stained a very dark color. This is most commonly seen in the legs of tables, piano benches, and chairs, where the more expensive wood has been used in the large surfaces. It is frequently sold under the name of "combination mahogany" pieces, which deceive the one not acquainted with the peculiarities of better wood. No wood, however, is better adapted to taking paint and enamel. The filler may be a colored commercial liquid filler, but shellac will give better results.

122. Pear.—For imitating ebony no better wood has been found than pear wood. It is hard and very close grained, taking a stain and polish well. The same treatment may be used for this wood as was suggested under *Apple,* Sec. 104, and under *Ebony,* Sec. 14.

123. Redwood.—California redwood, the giant of the American forest, is a coarse-grained wood of reddish-brown cast. The largest bar in the world was, in pre-prohibition days, composed of one solid piece from the trunk of one of these trees. Some of these trees, the last of their race, remain the wonder of tourists in Western United States.

A paste filler must be used in preparing this wood for finishing. Frequently an oil stain, in shades which Van Dyke brown, burnt umber, and burnt sienna yield, is used to obtain different effects between red and brown color. If the stain is allowed some time to sink into the wood, and is then removed with a cloth before it is entirely dry the grain of the wood may be

improved. It is however with curly redwood that the woodworker has most to do. The same treatment is suggested for this wood because wiping off the stain accentuates the wavy surface. In coloring the wood, hold rather to a shade of red than to one which is predominantly brown.

124. Walnut.—Mahogany, oak, and walnut, these three now comprise for the most part the woods of furniture making of the better sort. Oak cannot be successfully imitated altho many kinds of woods, most notably ash and elm, are used for this purpose. But mahogany and walnut can be. This has given rise to a great many methods of deceit which are daily being practiced upon the unsuspecting buyer. As in the case of mahogany, walnut should not be finished in a very dark color. It is well to apply a finish that will grow in beauty as it does in age.

125. American Black Walnut.—This is the wood which we know as walnut but which is only one of a considerable number of species. The texture is more open than close grained, the wood is beautifully rich in color, in all respects well adapted to the needs of furniture making, and takes any kind of polish equally well. Small wonder then that it has rapidly entered the first rank of valuable woods of commerce, and that it holds its place year after year among those who know the value of it. To the pioneers of America its value was both as a wood of beauty and a wood of durability. They made their chairs and tables from it, they also looked to the future of their buildings, and even to this day in many sections of the country can be seen buildings made from this wood.

126. Finishing Walnut.—To me there is one pre-eminent finish for walnut. This is oil. No matter how often we may take fads in finishes, this polish, which is the oldest known to man, returns to assume first rank. It is doubtful whether another kind of finish will ever be found to rival it. Oil has a beautifying and darkening effect upon any dark wood, but upon walnut its enrichening power is best seen. It adds a depth to the wood, throwing the figure of the wood into beautiful relief. It gives that beautiful softness which age only enhances. It is proof against any of the ordinary accidents which spoil other polishes, and can be renewed like wax from time to time by merely rubbing over the surface. The reason for its lack of use in furniture houses is, of course, the time and consequently the money, which are necessary to produce it. But like French-polish on mahogany, and wax on oak, oil remains the final medium for finishing black walnut.

There are, of course, many ways of producing a beautiful surface on walnut. The most common manner is to fill the wood with a paste filler colored with burnt umber, with or without a stain. Bichromate of potash stain may be used to give a slight orange coloring, and the wood may then be finished with orange shellac or varnish. Some prefer to oil the wood thoroly, leave it a day to dry, apply one or two coats of orange shellac, and wax-polish it. This is an excellent way to finish walnut, and in many ways superior to varnishing it. If carbonate of zinc is mixed with white wax, a grey or antique finish will be obtained. Brown wax will not show in the pores.

I would caution the student against imitating any wood with walnut. Frequently this wood is used by manual training teachers and others with a red stain to counterfeit mahogany. Such a procedure is never to be recommended. Walnut is our wood, a peculiarly national timber, just as oak seems to belong to England, and maple to Canada. Keep the individuality of it. It is nothing less than a violation of one of the principles of wood-finishing to attempt to make it look like something else.

127. Matching Color in Walnut.—The sapwood in walnut is almost white in color, and while this sapwood should be avoided whenever it is possible, it is often found after the piece of work is completed. Applications of strong coffee or tobacco such as are sometimes recommended will not serve well to match the color of the dark part of the wood. I advise the student to make a solution of walnut crystals and water (about two ounces of walnut crystals to the pint of water). A tablespoonful of vinegar will help this to bite into the wood. Apply this while hot to the light portions of the wood with a small soft brush. If this color is too dark weaken the stain a little with hot water. If you already have some potassium bichromate solution on hand try it to see what its effect will be on your particular piece of wood. It may be the color you wish. Or if it is too light boil a small amount of walnut crystals in it to see whether or not this will give you the desired effect. A more powerful color may be obtained by adding to the walnut crystals and water solution one teaspoonful of carbonate of soda. Finish the work with orange shellac, to which has been

added a very little brown aniline dye. This must be, of course, a spirit soluble aniline, and not a water or oil soluble. The dye may be omitted if the color is suitable, but a little coloring in the shellac will take away the yellow cast which may be objectionable. Another way of matching, which is done much more frequently in Europe than in this country, is to paint on successive coats of thin well-colored shellac with a small brush. One can easily reason how well the matching of figures on plain wood is accomplished in this manner. *In doing this never use a thick shellac.* Color the shellac with alcohol soluble anilines, and thin it to the consistency of varnish. All the student needs is an eye for color and a little care with the brush to match the figured parts of the wood so well that it will be difficult to distinguish them after the work is finished. If you are attempting to match a wavy or curly grain paint out the dark portions as nearly like those of the true wood as you can. Let the shellac dry and rub it down very lightly with fine sandpaper. In this way apply successive coats until the imitated figure stands out in color like the part that you are trying to duplicate. The work may then be polished or varnished as usual.

128. Filler for Walnut.—Walnut requires a paste filler of a little darker color than the wood. Van Dyke brown and burnt umber may be used if a light color is desired, or burnt umber alone if the wood is to be dark. Mix the color into the paste filler you have prepared or bought, and thin it with turpentine to a good heavy consistency. Brush the filler across the grain of the wood so as to fill the pores well. Allow it a

few minutes to become hard and then rub it off well with a piece of burlap. When it has dried thoroly, sandpaper the surface, and finish with shellac or varnish.

129. Some Final Remarks About Wood-Finishing. —In the previous pages on staining and finishing wood I have tried to keep before the student or amateur the necessity for appropriateness in all his work. The principles of wood-finishing are like other arts based upon two qualities, beauty and use. Of recent years a great deal of the so-called "mission" furniture has been copied by manual training schools. The reason for this was two-fold: first, square lines such as are common to this type are easily made by the beginner; and second, the style seemed particularly well adapted to the expression of the pioneer American characteristics of rugged simplicity and worth. The wood used for this is oak. How inharmonious then seems a bright-colored or shining surface on this furniture. Yet as I have visited the departments of manual arts in various schools I have observed this anomaly frequently. Sometimes I ventured to ask why the particular finish was applied, and all I could learn was that the teacher and the students thought that wood was wood, that design was design, and that finish was finish, without any thought of the artistic whole which was to be the result of these three happily blended and adapted to each other. Is there any reason why manual training departments should work as if varnish were the only kind of finish that can be applied to wood? Is there anything to be gained by following the example of makers of cheap furniture whose sole

aim in the finishing department as in all others, is constantly to find a cheaper substitute, something that will fool the customer until the sale is made? I think not. At some time not far distant we shall be sufficiently enlightened not to buy "walnut" furniture which is almost entirely basswood, or mahogany which is poplar, or oak which is ash and chestnut. And any manufacturer who allows his product to be placed upon the market under such an assumed name is worthy of all the contempt that may be shown to his furniture. We attempt to make it illegal to sell cotton mixed clothing under the name of wool, but we as yet have no way to force the furniture man to call his product by its true name.

130. Aids in Selecting Colors.—The following few things may help the student to a wise choice of color in his staining. When the problem of finishing a piece of work comes before you the first thing to consider is the color you wish it to be. This may be that of the wood itself, in which case, of course, no stain is needed, but usually the natural wood will need to be softened and enriched. The question that we must then ask ourselves is, "What is the dominant color of the wood in its natural state?" This surely will ordinarily be a safe criterion for the selection of a stain. In this way we shall add to the individuality of the wood rather than take away its identity. The type color of oak is brown. Why do we then sometimes do violence to the wood by making it green or red? Surely that is not artistic. But the story of this wood may be enhanced in another manner. Oak is the wood of the ages. How many times have we seen the old planks

of ships battered and blackened by weather, and the pores of the wood whitened by the salt from the sea. Certainly it is not a desecration of the wood to try to reproduce this effect. When we are able to accomplish this we add to the charm of the wood by giving it a weathered or antique appearance. Suppose, for example, we take another wood, birch. Now birch is a beautiful wood and one which has distinctive traits. It is also an excellent wood for construction. Why then seek to make a fake mahogany out of it? The color of the wood varies in shades of reddish brown, red being more often the dominant or *type* color. Instead of attempting to produce an imitation of another wood of entirely different nature and traits, does it not seem more in keeping with common sense and the principles of art to intensify and to enrich the characteristics of the natural wood? Similarly we might consider mahogany, maple, cherry, and walnut, and in all the principle would remain the same, *to use wood which has merit of itself* and *to attempt by the art of the finisher to give due prominence to that merit.*

131. Points on Polishing.—All these things apply in the first place to the matter of staining and filling the wood, but they are equally applicable to the question of polishing. As in the first place we declared that the prime factors were beauty and serviceability, so will these be retained in the present discussion. I have said that golden oak, as it is sold in furniture houses, is the most inartistic of wood-finishes. My reason for saying this is that it seems to me to be the most inappropriate treatment for the wood. Anything that serves to detract from the natural charac-

teristics of this wood is inartistic. This is more strictly applicable in the case of oak because this is the greatest wood from every point of view, that we have. Oak should not be conceived as a highly decorative wood, but rather as a wood with a story of serviceability to mankind. The kind of finish, then, which is suited to the more decorative woods is not appropriate for oak. Curly walnut, highly figured mahogany, and other woods of this class seem to claim special treatment by the finisher to throw into relief their charm, but oak is sufficient unto itself. The less we do with it the better. All the finish that is necessary is that which will keep it from being discolored and dirty. And while I am speaking of this wood I may add that it is a question for debate whether quarter-sawed oak is, in any respects, more suitable for furniture than plain-sawed oak. If it comes to a matter of which is preferable for a table top, plain oak or quarter-sawed veneer, I think there can be little hesitation in choosing the former. I can tolerate walnut veneer in some places, I can admire the beauty of fine mahogany veneer, but veneer of oak—well I cannot look at it without a feeling of revulsion. The salesman will of course prove undeniably that veneered work is stronger than solid wood, and many other selling points which are more amusing than illuminating, but still you know it is like wearing a cotton shirt with a silk front, you can't take off your coat. In other words, it does not bear inspection. As the salesman may say, of course, the cotton will wear better than the silk. The point is that we admire and wish to possess genuine things.

CHAPTER XII

Finishing Floors

132. Floors, Finished Like Furniture.—The problem of finishing floors is one which comes to most of us occasionally. In some respects it is similar to that of finishing interior woodwork, but in others it is quite different. The main expense of floor finishing is in the manual labor, and there is usually no need for even an amateur to engage the services of an expert except on work which requires special treatment. Here as elsewhere, a little care and work will produce excellent results.

133. Hardwood Floors.—The most common woods for hardwood floors are maple and oak. We shall then give these a detailed treatment. *If an oak floor has not previously been finished* the first thing to do is to stain it, or, if the work is to be left in the natural color, no stain is, of course, necessary. The most appropriate color to stain oak is in some shade of brown. Remember this in any treatment of floors and you will save yourself some future disappointment: the floor of a room should have the appearance of substantiality and of strength. This is not easily obtained in light colors. I suggest then that unless you have some special reason for not darkening the wood of your floor that you stain it with a suitable color. Brown oak in this case is quite desirable. For work on floors I have found an oil stain best, the difficulty with a water stain being that it is difficult to keep as hot as it should be applied, and also that it roughens the fibers of the

wood to such an extent that they must be rubbed down with sandpaper at some subsequent time in the process before the varnish, shellac, or wax is applied. For all general purposes then use an oil stain. Apply this to the wood which has been very carefully smoothed with a scraper and sandpaper. A good, wide brush is best for this purpose. The stain should flow freely from under the brush, and not be thick and muddy. If this stain proves too strong add a little good linseed oil and turpentine to it. Do not use so much stain on the brush at one time that the excess flows into small depressions and forms minute pools. Work the brush generally in the direction of the grain of the wood, and do not attempt to cover a very large surface at a time. You may save yourself the trouble of having to obliterate *laps* by staining a few boards at a time, going entirely across the floor. If the outer edge of your stain colors just to the edge of a board each time you will not cover any part of the floor a second time. This is worth observing because two coats of stain on any part will add more color than one coat, and consequently any overlapping in staining is apt to show in streaks. Allow the stain to dry over night and then remove any excess greasiness with a dry cloth.

134. Filling Oak Floors.—Oak is a very porous wood and unless a filler is applied to seal the tiny pores it will drink up a great amount of varnish. The following filler may be used very satisfactorily on brown oak:

1 quart good linseed oil (boiled or raw).
1 pint brown japan.
½ pint pure turpentine.
Silica colored with burnt umber.

In preparing this mixture, pour the liquid ingredients together and add sufficient silica to make a good heavy paste (a little thicker than ordinary paint will be about right). Then add the burnt umber, stirring the mixture constantly, until a chocolate brown is obtained. Apply this to the floor *across the grain of the wood* with a brush. Allow the filler to dry for fifteen or twenty minutes, or until the surface of it appears *dead* or *flat,* and then wipe it off *across the grain* with a piece of burlap. The filler should not be left to dry until it feels very sticky. Wipe off every particle of it that you can. A word of warning is very necessary here; *do not apply* the filler to a surface larger than you can take care of in case the filler suddenly becomes sticky. Work on a small area at first until you see how much you can conveniently cover at a time. The floor thus filled should be allowed thirty-six hours in which to dry. The surface may then be rubbed down with No. 1 sandpaper. Using the block suggested under *Sandpapering,* Sec. 5, will be the most convenient way of doing this. If one coat of filler does not completely *fill* the wood apply another coat, treating it in the same manner. It is necessary to do this thoroly if a satisfactory result is desired.

135. Finishing the Floor.—When the floor is thoroly dry and smooth it is ready for finishing. This may be done in several manners according to the need of the work. The first part of the process is similar in all cases, however. Whether wax or varnish is to be the finish, a thin surfacer should be applied immediately over the stained and filled wood. This surfacer may be orange shellac thinned down to almost a watery

consistency; or a thin copal varnish. Orange shellac must be thinned with *denatured* or *grain* alcohol, *not with wood alcohol.* Varnish is reduced with *pure turpentine.* Never use a cheap grade of turpentine for this. The object in thinning the surfacing coat is to allow it to enter or "bite" into the wood so that it may not dry in a cake upon the surface of the wood and peel off with the subsequent coats of varnish after it is subject to wear. This coat must be left a sufficient time to *dry thoroly.* This fact cannot be overstressed. Amateurs are prone to judge whether or not varnish is dry by feeling it with the hand. If it feels hard they immediately assume that it is dry. Such is not the case. A thin coat of shellac will be dry enough to rub after four hours, but varnish should be left thirty-six hours or more to harden before any rubbing is attempted. You may experiment with this if you wish, but it will be to your distress and expense if you do. After this surfacing coat has become dry and hard, rub down the surface with No. 0 sandpaper, and wipe off any dust with a clean cloth. Then apply a full coat of floor varnish or good rubbing varnish, not thinned with turpentine. If shellac has been used as the surfacing coat it may be used again, but for this work varnish is most easily applied and satisfactory. The point to remember is this: varnish may be applied over shellac, but shellac must not be applied over varnish. This second coat should be allowed two days to dry. It may then be rubbed down with No. 0 sandpaper, but the rubbing must be done in the direction of the grain. Indeed all sandpapering should be done in this manner. Dust off the surface again and,

if a good job is desired, apply one more coat of varnish. This should not be rubbed within less than two days. No. 00 steel wool may then be used to take down the surface for the last time and the floor may be polished in the usual manner with floor wax.

This is one of the best methods of treating oak floors, but in case a cheaper and quicker job is necessary, I shall add an alternate treatment. The cheaper work will, of course, always be less satisfactory than the other, but it will give as much satisfaction as the ordinary run of finishes that are applied by hired workmen. Stain the wood or leave it in the natural color as is desired, fill the pores with the paste filler suggested above, and apply one thin coat of thin orange shellac. Allow this three or four hours to dry, rub down the surface, and apply one coat of varnish. Give this two days in which to harden, smooth off the surface and finish with floor wax. If the wood is to be finished in its natural color add only a very small amount of burnt umber to the filler, just enough to make a light brown color.

The object in finishing a floor is primarily to make a hard smooth surface which will protect the wood. Many people suppose that a few heavy or thick coats of varnish do this. The opposite is true. A film of varnish on wood should be very thin in order to do its work most effectively. A thick coat is sure to chip off and crack as soon as it is subjected to wear. A floor finished in the first manner given, will, with a little care, last for half a generation. The wax must be renewed from time to time.

A less permanent but quicker method than either of

the above finishes is to omit the varnish or shellac entirely. After the wood has been stained and filled, apply one coat of thin orange shellac or thin floor varnish to the wood. If shellac is used it will be ready for polishing much more quickly. When the varnish or shellac is dry rub it down with fine sandpaper and wax-polish it.

136. Finishing Maple Floors.—Maple floors are usually, but not necessarily, finished in the natural wood. If no stain is desired apply a coat of thin white shellac to the wood, allow this a few hours to dry, and then wax-polish it. Do not apply oil directly to any light-colored wood if you wish to preserve its beauty. Oil makes a dirty brown color on maple which is far from desirable in a house. If a stain is used, which is not a common procedure, it is better to use a water stain such as has been described in the earlier part of this book. After this has become dry, apply a coat of thin white shellac and rub down the surface with fine sandpaper. Varnish, usually not more than one coat, or wax, or one coat of varnish followed by wax, may then be applied. Very often no shellac at all is applied to maple that is to be finished in the natural wood. The surface is polished from the beginning with wax. A much greater degree of satisfaction will be had, however, if a coat or two of shellac are applied before the wax. Again a pale copal varnish may be used as a surfacer instead of two coats of shellac. The best method to follow is probably to apply one coat of white shellac directly to the wood. This serves as filler and surfacer to maple, altho it would not be sufficient for most other woods. When

this has become dry, rub down the surface with fine sandpaper, and apply one or two coats of pale copal varnish (a good quality of floor varnish will do well). Be sure that each of these is dry before beginning to work on them. Rub down both coats or at least the second coat with fine sandpaper, and wax-polish the floor.

Wax is not a permanent finish in any sense of the word. It produces a pleasing satiny luster on the work, but soon wears off, and must be renewed. For floors which are subjected to a great deal of hard usage, or where water is frequently spilled wax is not suitable. It is better to apply some good quality of floor varnish.

137. Finishing Softwood Floors.—Pine and fir are commonly used for floors where a softwood is desired. These are finished in quite a similar manner to hardwood floors but it will perhaps be well to suggest some treatments of them in a detailed way. Pine is frequently finished in the natural wood. Fir has little beauty in itself and should therefore be stained. In the case of either wood a water stain should be used in preference to spirit or oil stains. It will always be well, however, to test the effect of a new stain upon a block of wood before using it. It may not be at all what you wish. Water stains are quite brilliant, and one should always use a little darker shade of color than he finds the stain advertised to be. The worst thing that could happen to one would be to achieve a striking or noticeable floor where the effect should always be unobtrusiveness. If a water stain is used, apply it hot to the wood with a large brush, taking care to avoid overlapping, (see Chapter II). The wood

must then be filled, but this time with a liquid filler instead of a paste filler. The easiest way to make a liquid filler is to add sufficient silica to some varnish to make a heavy mixture, not so thick as paste. Then thin this with pure turpentine to the consistency of the varnish before the silica was added. Burnt umber, Van Dyke brown, burnt or raw sienna, or drop black may be added, to color the filler to approximately the same shade as the stained wood. Apply this filler like varnish, allowing it at least a day to harden. Liquid filler is not wiped from the wood as paste filler is. It is treated exactly as a coat of varnish, and is rubbed to a smooth surface after it has become dry. The floor may then be given one or two coats of good floor varnish, each being allowed forty-eight hours to dry, and afterwards rubbed down with fine sandpaper or No. 00 steel wool. If the wood is to be finished in the natural color no special filler is needed. One coat of shellac, rubbed down, and followed by one or two coats of floor varnish, will serve admirably.

138. Painting Softwood Floors.—The best finish for softwood floors is paint, but ordinary paint will not be satisfactory. The best way to proceed is as follows: Clean the wood well, removing all dents and filling all holes with a shellac and sawdust paste. Any resinous knots or portions of the wood must be covered with a coat of shellac. When the surface is thus prepared apply a good priming coat. Rub this down with sandpaper after it has become dry. Then apply two coats of good floor or *deck* paint, giving the first ample time to dry before the second is applied. The requirements for a good finish are: good materials,

cleanliness, and time. Nothing will so easily spoil your work as haste. A few hours of additional drying time will repay you in every way. All paint or varnish should be warm, that is, of the temperature of the air in mild weather (about seventy or seventy-five degrees), and the floor or woodwork should be kept at the same temperature for good finishing.

139. Repainting Old Floors.—Often the problem of repainting an old floor presents itself. This does not involve any new processes except the removal of the old paint. A *paint and varnish remover* will do this, but time and expense may be saved by blistering most of the old finish with a blow torch and then scraping it off with a steel scraper or other convenient tool. Almost all the old paint can be removed in this way. The few spots that remain can be softened and rubbed off with wood alcohol or some commercial liquid prepared for this purpose. If a good finish is desired you will do well to wash the wood with strong soap and water solution, applied hot. Then allow the wood to dry, rub down with sandpaper the fibers which the water has caused to rise, and apply a priming coat. Usually one coat of *primer* will be sufficient for surfaces which have once been finished. The rest of the painting may be done in the manner suggested in the previous paragraph.

140. Revarnishing Floors.—The old varnish and wax must be completely removed, not as paint, with a blow torch, but with some prepared varnish remover. If this is not to be had, wood alcohol will do the work but it will usually take more time. The surface to be revarnished must be more carefully cleansed of all

dirt than was necessary for repainting. In either case it is well to wash off the wood, after the old finish has been removed, with strong soap and hot water. Floors which are uneven or warped should be smoothed down with a floor scraper. This is more often necessary in refinishing hardwood floors than with those of soft-wood. If any scraping is done the wood will have to be *filled,* otherwise restaining and finishing may proceed as before suggested. If a varnish remover is used at any time, use care in handling it. Removers of this kind are usually poisonous and very inflammable.

141. Filling Cracks in Floors.—A good filling for cracks and holes in floors may be made by mixing up a stiff paste with shellac and sawdust. This should not be placed in the cracks until the work has been stained and surfaced with a coat of shellac or varnish. This will enable you to determine exactly what shade of color to mix with the paste to match the stained wood. Burnt umber will produce a reddish brown, Van Dyke brown is much darker, burnt sienna is red. Any of the *spirit aniline dyes* will do well for this purpose. A mixture of glue and sawdust may be used instead of the shellac paste, and indeed, it is much more easily used because it may be applied before the stain and filler and will absorb the stain readily, a property which the shellac paste does not have. If paint is to be used as the finish, holes or cracks may be filled with putty, or shellac and sawdust, or glue and sawdust paste. Shellac dries so quickly that it is not recommended for a large amount of work.

142. Removing Stains from Light-Colored Floors.—The easiest method of doing this is to rub the discol-

ored wood with a cloth dipped in a solution of oxalic acid and water. A good strength to make this solution is four ounces of the acid to a quart of hot water. If the spots do not come out in one application, repeat the process. After the discoloration has been removed be sure to wash off the spot with vinegar before any finishing is done. This will prevent the acid from continuing its work after the surface has been polished. If the whole floor is dirty, a wood bleaching agent may be had by making a strong solution of washing soda in hot water, or a solution of oxalic acid and water half the strength of the one mentioned above.

CHAPTER XIV

Turned Work

143. Difficulties in Finishing Turned Work.—The problem of finishing turned work is in some respects different from that of finishing ordinary projects. In the first place remove all grease marks. A great deal of care is necessary to obtain an even color to the whole surface because a part of it, indeed often a great share of it, is of *end grain.* Obviously, it will not do to put the same amount or strength of stain on these very porous parts as on the closer-grained portions. If we did this the open wood would be much darker than the other. The first thing necessary is a very smooth piece of work. Nothing but the finest sandpaper must be used for the final smoothing, and *this must not be done while the wood is turning in the lathe.* The final polishing must be done in the direction of the grain as far as possible. If you neglect this your finished product will be far from satisfactory. In the second place it is better not to use a water stain on turned work. The quantity of fibers which will rise from the action of the water will necessitate a long process of smoothing. The best stain for the purpose is an oil stain because it does not sink into the wood rapidly as do those which have spirit or water as their solvent. The easiest manner of procedure in staining is to stain the nearly flat grain first with a single coat. Then thin this stain to half its former strength by the addition of turpentine and apply

a coat of it to the porous parts of the work. Allow this at least two hours to sink into the wood, and then wipe off any excess grease with a clean cloth. You will probably now see that certain parts of the work are lighter than others. Take a *small brush* and paint over these parts with the thin stain. The wood will then be quite evenly colored. Oil stain requires a longer time to dry than other stains and it should not be hastened.

Do not attempt to fill turned work with anything except pure shellac, and do not attempt to apply this while the wood is revolving on the lathe. Paint it on with a brush and allow it to dry as with any other piece of work. Two coats or more will be necessary to fill the grain, but they should be of *thin shellac.* Rub down the surface, after each application has dried, with fine sandpaper. But do not do this across the grain of the wood. The work may be polished with wax or French-polish, or varnished. Varnish may be rubbed to a good dull finish with a piece of felt dipped in water and *rotten stone* while the work is revolving at a slow speed, but the student must take care not to press hard on the felt, or to allow it to become dry while he is doing this. Be careful not to rub off corners. Oil instead of water will produce a finer finish but it is apt to soften the varnish if it is used continuously on one part. If you use oil, work rapidly and remove the moisture from the varnish as soon as you have obtained a polish.

144. Some Easy Ways of Finishing Turned Work.— One of the easiest ways of finishing mahogany, walnut, and oak is to smooth the wood very carefully

with fine sandpaper while it is revolving; then to remove all transverse lines that the sandpaper has made, by rubbing it in the direction of the grain; following this, to smooth the work by holding a handful of fine shavings against the wood while it is revolving; and finally to polish with raw linseed oil and turpentine (two-thirds oil and one-third turpentine simmered together over a slow fire for five or six hours). Do not attempt to apply a great deal of oil at a time. The oil is really of more service as a darkening lubricant than as a polishing agent. A piece of billiard felt is the best thing for rubbing turning wood. A finish will be obtained much more quickly if a coat of thin shellac is applied to the work after one coat of oil has been given to it.

Another easy and excellent manner of polishing turned work is to use wax. Stain the wood with an oil stain, if it is not to be finished in the natural color, and apply a coat of thin shellac. Polish the project with wax while it is revolving in the lathe. Do not apply a large quantity of wax at a time. It is better to go over the work once and then leave it ten minutes to harden. It may then be polished with a piece of billiard felt or other woolen cloth. Repeat the process until a good gloss is obtained. If an aged appearance is desired use white wax (paraffin and turpentine to which has been added a little *zinc white*) for polishing. This will show in the grain of the dark wood as gray streaks, a very pleasing effect upon some designs. The wax may be colored, of course, with any of the chrome colors to suit the needs of the work.

APPENDIX

Suggested Stock Equipment for a High School Finishing-Room

Sandpaper. A good quality of *garnet paper* in sizes ranging from No. 1 to No. 000 is always serviceable.

Containers. Several good clean quart jars with covers, several tin containers with friction lids, and a few flat sauce dishes into which to pour varnish and shellac for immediate use, are necessary. These should be kept clean at all times. It is good shop ethics for the student to take care of all brushes and dishes that he uses as soon as he has finished his work.

Oil. A gallon of *pure* linseed oil is a necessity in every shop. Only the best quality of oil is worth buying as a cheap grade will do more harm than good to any work.

Turpentine. Insist upon having turpentine that is marked *Pure Spirits of Turpentine.* Nothing else will do.

Alcohol. Denatured alcohol *188 proof* will serve the needs of the shop quite well. A gallon of wood alcohol may be used instead of commercial varnish remover if a great deal of refinishing is to be done. Ordinarily, however, two quarts of denatured alcohol will be sufficient.

Brushes. The number of brushes will depend upon the work which is projected. If painting and enameling are to be done extra brushes will be needed. Two varnish brushes and two for shellac are indispensable.

One of each of these should be of a good width for large surfaces such as table tops (2½ or 3 inches), the others smaller for more minute work (about seven-eighths of an inch). Do not use the same brush for shellac and varnish.

Care must be taken in choosing brushes. A cheap brush is worthless at any time. You will save a great deal of inconvenience and trouble by buying good brushes and *taking care of them.* An old paint brush makes a good tool for applying paste filler, and a fine camel's hair brush will be necessary for imitating grain formation on straight-grained wood. Read over Sec. 83 on the care of brushes. It will be time well spent. One brush of a convenient size and cheaper quality is all that is necessary for applying stain. It must be cleaned like other brushes after it is used, and carefully dried.

Silex. Two pounds of finely powdered silex is necessary for making fillers. It is much cheaper to make your own fillers than to buy them already prepared.

Silica. Three pounds of silica may be used to supplement the silex in cheaper work. It makes, ground in oil, an excellent filler.

Burnt Umber. A pound or more of burnt umber is a constant necessity in every finishing-room. It is very inexpensive, as indeed are all the pigments listed here.

Burnt and Raw Sienna. These pigments *ground in oil* are among the most common needed for stains and fillers. A pound of each should be sufficient.

Chrome Colors. A few of the ordinary colors should be kept in stock for coloring wax and oil stains.

Drop Black. This product is much better than lampblack for making colored fillers and stains. A pound of this should be enough.

Van Dyke Brown. Like burnt umber this pigment is in constant use where students are working with oak, ash, mahogany, and walnut.

Mahogany Red. A pound of this powder is necessary in making stains. Be sure to get that which is *soluble in water.*

Mahogany Brown. With this powder a great variety of shades from deep red to deep brown may be obtained. As with the former, be sure to get a *water soluble* powder.

Potassium Bichromate. A pound of these crystals is a necessity in obtaining the rich brown effects seen on oak and mahogany.

Ammonia. If fuming is to be done be sure to get full strength (specific gravity 880) ammonia.

Aniline Dyes. It is well to have on hand a few of the common colors in aniline dyes of three kinds, water soluble, oil soluble, and spirit soluble. They are very inexpensive and excellent for students' use. In using them, the student will have to guard against making too strong a stain. They are very strong, and a small quantity (about one ounce to the gallon of solvent) will usually be sufficient.

Alkanet Root. This is a reddish powder which is soluble in oil. As a coloring for mahogany it is unsurpassed. To make the stain, suspend four ounces of the powder, contained in a piece of muslin, in a pint of linseed oil. A day will be necessary for the stain to become sufficiently strong. After this the sack

may be removed from the oil and the stain placed in a well-stopped jar.

Pumice. The best pumice for rubbing shellac or varnish is obtained from Europe. The American pumice is apt to be gritty. A fine grade of pumice is best for general work, but even this should be sifted thru a muslin "pounce bag." No. FF pumice is fine enough for ordinary manual training needs.

Rotten-stone. This should be kept in a dry place, and used only for extra fine finishes. Buy it in powdered form. It is very inexpensive, costing from eight to ten cents a pound usually. Three or four pounds will be sufficient for the small shop.

Felt. A good piece of harness felt makes a suitable rubbing pad for shellac or varnish. If you wish something better order two pounds of hard or soft Mexican felt.

Wax. Both paraffin and beeswax are used as polishing agents. The beeswax is most commonly used, altho paraffin takes a higher gloss. The latter is more easily destroyed however. It is usually well for the student to mix his own wax for polishing, because it is much less expensive and serves its purpose admirably. Many of the prepared floor waxes are excellent. A pound of beeswax or paraffin would be sufficient for the needs of a small shop unless a great deal of this work is to be done.

Shellac. The shellac may be bought in prepared form (dissolved in alcohol), or in gum form. For general use the prepared form is much more convenient than the other, but it will have to be thinned considerably before it is used. Every manual training shop

will need at least a quart of pure orange shellac and a quart of bleached or white shellac. Be sure to keep the containers of these well corked as alcohol evaporates very rapidly. Under no circumstances allow water or oil to be put into the shellac. Do not keep shellac in tin cans, the metal will discolor it.

Varnish. At least two kinds of varnish will be necessary for interior work: an elastic oil varnish of any good quality for work which will be subjected to hard usage, and a *rubbing varnish* which is more brittle (shorter in oil) but which takes a higher polish for fine finishing. In buying any varnish, it is well to buy the best quality and to rely upon the honesty of the manufacturer in his suggestions of the use to which the particular kind is best adapted. A word of warning should be added to the student: do not depend too much on the value of the many widely advertised *special varnishes.* Buy a good, staple varnish from a reliable company. You have then something upon which to fall back if it is not satisfactory. The greatest care will be necessary in selecting the *rubbing varnish* for this will be in almost constant demand by the manual training department. There are many good *pale copal* varnishes on the market, altho the word *copal* now signifies nothing in regard to the value of the varnish. If the work calls for perfectly transparent finishing use white shellac in preference to *damar varnish* as the latter is too soft for final coating.

Rags. A quantity of cotton waste, burlap and washed white muslin should be kept on hand.

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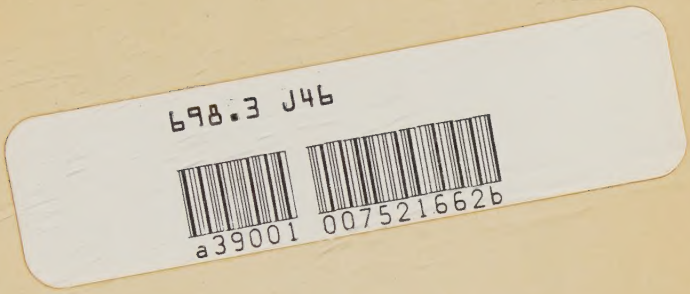

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